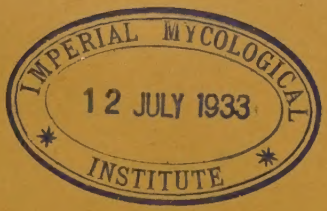
TANGANYIKA TERRITORY

DEPARTMENT OF AGRICULTURE

Annual Report

1932



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DAR ES SALAAM
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DEPARTMENT OF AGRICULTURE.

ANNUAL REPORT, 1932.

Staff.

The Director was in control of the department throughout the year. Essential assistance was rendered in Head Office by the secondment of Mr. L. A. W. Vickers-Haviland from the Administration. During the year the following changes were recorded :—

(i) Mr. W. B. Hutchinson, District Agricultural Officer, and Messrs. G. H. Pattison, M. Wright and G. H. Turnbull, Agricultural Assistants, left the service.

(ii) Messrs. J. G. M. King and J. C. Eyre were appointed as District Agricultural Officers; Messrs. A. Young, M. Wright and L. F. Higgens were appointed as Agricultural Assistants.

At the close of the year the staff authorized was :—

Head Office: Director; Administrative Officer; three European Clerks and part-time assistance from the Senior Agricultural Assistant.

Scientific Staff: Entomologist; Mycologist; Assistant Entomologist.

Field Staff: Three Senior Agricultural Officers; Agricultural Lecturer; twenty-six District Agricultural Officers; Senior Agricultural Assistant and fifteen Agricultural Assistants.

It will be observed that Head Office staffing has been considerably reduced, and one Senior Agricultural Officer and two District Agricultural Officers' posts have been suspended.

Finance.

During the year a change over from the April-March financial year was made, so that, officially, 1932 funds were provided as to three months, January-March, from the 1931-32 appropriation and as to nine months, April-December, from the 1932-33 estimates. A table showing the provision made for expenditure for the nine months, April-December, 1932, and the estimated amount expended during that period will be found in Appendix V.

GENERAL REVIEW OF THE YEAR.

(By the Director).

The 1932 season was good in parts, and on the whole it cannot be said to have been above average. Locust infestation continued and spread to the southern areas of the Territory, causing much misgiving and some significant destruction of foodstuffs. Generally, the people were fortunate but food shortages in small areas have been reported. Usually these shortages have arisen where native people gave little or no heed to the directions and advice of their administrative officers.

Tabora, Singida and Dodoma experienced a drought of short duration but coupled with locust visitations it had the effect of reducing the surplus of production for export. Lindi Province suffered somewhat from adverse weather conditions, whilst in Mwanza, there was perhaps too much rain. Over the rest of the Territory, conditions were normal to good, and it may be said that, generally speaking, native people are a little better off now (January, 1933) than they were a year ago, but their condition admits of much improvement still. No relaxation of effort should be permitted to interrupt the gradual progress to recovery and advancement.

In last year's report, reference was made to the need for an increase in planting, particularly of annual crops, by native people in order to combat poverty. During the year, the tonnage of production for export has increased above the previous best year, 1930, by over 15,000 tons, which in the face of locusts and other adverse conditions, coupled with low prices, is an achievement.

The tonnage of domestic exports of an agricultural nature reached 103,000 tons in 1930, of which one-half was sisal. The tonnage fell to 96,000 tons in 1931, whilst in 1932 the tonnage exported is in the region of 119,000 tons. By taking the maximum tonnage of each export crop produced during the past twenty years, and totalling, we arrive at a figure of 125,000 tons as the possible fair maximum if season and people are at their best. The Territory must surpass the figure of 125,000 and attempt to reach 150,000 tons in 1933 by added energy and extension of activity, and briefly that is one of the major problems to-day. The following table shows both export tonnage and values for the chief agricultural products for the past three years and figures for the peak year of each crop. For information, a column has been added showing the amount of preference in the Empire which each product now enjoys under the Imperial tariff scheme.

PRODUCT	Maximum Output for Export		1930				1931				1932				Amount of Preference granted in accordance with the Ottawa Agreements, vide General Notice No. 1355 of 28th November, 1932
			Amount	Total value	Value per ton F.O.B.		Amount	Total value	Value per ton F.O.B.		Amount	Total value	Value per ton F.O.B.		
	Year	*Tons*	*Tons*	£	£	*s.*	*Tons*	£	£	*s.*	*Tons*	£	£	*s.*	
Sisal ...	1931	55,939	49,962	1,172,315	23	13	55,939	707,177	12	13	60,554	698,056	11	10	U.K. 10% *ad-val.*, India 10%
Hides and Skins ...	1913	3,456	2,936	123,471	42	11	2,111	83,915	39	15	2,718	99,474	36	12	Nil.
Cotton Lint	1929	4,947	3,670	247,413	67	8	2,426	119,752	49	7	3,209	183,747	57	5	Nil.
Copra ...	1928	9,318	7,395	109,733	14	16	7,234	62,209	8	12	7,265	64,694	8	18	U.K. 10% *ad-val.*, India 10%
Groundnuts	1924	18,684	17,333	186,567	10	15	3,070	28,706	9	7	15,873	182,010	11	9	U.K. 10% *ad-val.*
Beeswax ...	1931	607	188	20,297	143	6	607	47,010	77	9	391	31,965	81	15	U.K. 10% *ad-val.*
Coffee ...	1930	11,547	11,547	397,040	34	8	9,251	247,037	26	14	11,362	463,597	40	16	Per lb. U.K. 1d., New Zealand 1d., Newfoundland 2c., India 1a., South Africa 1d., Southern Rhodesia 1d.
Sesame ...	1923	4,435	3,115	32,547	10	9	3,828	36,715	9	12	4,811	50,130	10	8	U.K. 10% *ad-val.*
Rice ...	1931	4,754	4,556	73,682	16	3	4,754	51,209	10	15	5,385	62,939	11	14	Per lb. U.K. 1d. (clean husked).
Millet ...	1928	7,732	1,814	8,234	4	10	5,270	20,710	3	18	3,529	14,911	4	4	Nil.
Maize ...	1931	1,769	192	995	5	4	1,769	7,401	4	4	2,823	11,999	4	5	U.K. 10% *ad-val.*
Gums (Arabic & Copal)...	1929	1,018	553	14,836	26	16	482	10,583	22	0	1,033	15,540	15	1	Nil.
Ghee ...	1913	1,287	293	16,385	55	18	293	11,549	39	8	359	16,848	46	19	Nil.
Totals ...		125,493	103,554	2,403,515	23	8	97,034	1,433,973	14	16	119,312	1,898,056	15	18	

It is now that the "Plant *more* Crops Campaign" of which so much has been heard, can be said to be required, in order to lift the Territory one step higher, to set a new standard in the extent of cultivation and the volume of surplus outturn. To achieve this end, simple straightforward action is necessary. Cash for produce, grading and supervised marketing, faith in the ability to dispose of any quantity at a fair price, and the more widespread use of vehicles for produce collection are all important factors.

A more general recognition of the fact that a native district is in the nature of an estate requiring management and development, with an appreciation of the functions of various officers and their conjoint or team work is important. Furthermore, it should be realized that it is from the present efforts of the inhabitants at production that funds will be forthcoming for future requirements in sanitation, education, and local organization generally. The prime importance of agricultural and agronomic work in the provision of the "sinews" should be appreciated as there appears to be no other available source which can be tapped to provide the means. It therefore would seem that active, even enthusiastic support by everyone should be accorded to all measures which are likely to result in realizable surpluses, and anything which militates against the success of such an endeavour should be examined with a view to its amendment or removal.

There has been a decided reaction in favour of more careful and intelligent handling of coffee estates and plantings on the part of many coffee growers, and the department has been actively engaged in an endeavour to introduce cultural practice more in conformity with the needs and habits of the coffee tree, having due regard to climatic conditions.

Problems in connection with the Copra Industry have received attention, they are not incapable of solution being confined to three main factors : theft, copra preparation, and culture. The first is already being tackled, preparation will be improved by demonstration followed by inspection, and improvement in cultural methods on general lines is not difficult. An agreement has been come to with the authorities in Zanzibar that whatever inspection of copra is finally decided on, will be applied equally in the Island and in certain areas on our coast. As Zanzibar is the main market for Tanganyika copra, the value of such an arrangement is manifest. It is estimated that our copra loses up to 20 per cent. of its real local value because of bad preparation, which it is not a costly thing to rectify.

Notwithstanding low prices, the volume of export produce is rising and, with the exception of sisal and grains, present prices offer a sufficiently great inducement to further production.

Development.—There is a small but steady private development taking place in tea, tobacco, even sisal ; various milling installations, such as oil mills, small sugar mills, rice mills, a flour mill, coffee hullery at Bukoba, and so on ; in fact considering the times there is evidence of a quiet and reasonable enterprise.

Government has sanctioned an appropriation for a large Coffee Experiment Station on Kilimanjaro, and following the passing of the Coffee Factories Ordinance finance is forthcoming for a coffee factory in the Northern Province.

The tobacco factory in Dar es Salaam is developing its business satisfactorily. Furthermore, there is an increasing enquiry from overseas regarding Tanganyika produce, a number of produce merchants have made visits to and

taken a tour through the country, disseminating ideas regarding produce they could handle. No doubt the Ottawa Conference has had its influence and there is every possibility of our produce finding new markets providing quality is achieved and volume of production sufficient.

Motor lorries are venturing afield and aiding production, especially native surplus, the head porterage restriction on production is fast disappearing in the more populous areas. It is hoped that natives in mixed farming areas will come to use ox-drawn two-wheeled carts and four-wheeled trollies which should help considerably in enabling them to market cheaply the much desired increased individual production.

A ginnery has been established in the Kilombero Valley, thus adding a new and potentially extensive area to the cotton districts of the Territory.

Attempts are being made to utilize the large areas of citrus which exist in Tanga Province. These were planted in connection with the coagulation of rubber latex, and at present are not utilized. Manilla sets are being multiplied at Amani, and on some estates in the Tanga District.

In the Southern part of Iringa Province an added impetus will be given to coffee planting now that the high quality of the coffee there produced has again been confirmed by the market, but great care will need to be exercised to fit the methods of cultivation to the tree and the soil and the climate : a not too easy undertaking. Further, the demand for foodstuffs on the Lupa Goldfield is engendering production and trade.

One would here draw attention to a possible misconception as to the relative commercial results to be secured from annual crops as against permanent crops, such as cotton, groundnuts and rice, as against coffee and sisal.

It may safely be said that were the same thought and attention given to the cultivation and production of annual crops as is now given to coffee and tea, there would be commercially little to choose over a series of years between the two. A native family is quite capable of producing a bale of cotton lint or over half a ton of groundnuts or a ton of rice without calling for assistance at any time. Yields from large scale plantings bear this out, and measured yields from small native gardens which are well cultivated show equally generous results. Differences in season may be more acutely felt with annual crops, but in most seasons their cultivation does show a fair profit. This is particularly so in parts of the Eastern Province, and it is anticipated that plantation work with annual crops will extend as planters become better equipped and more experienced.

In case the urge for more planting of cash and food crops on the part of native people should create anxiety regarding the labour supply, it should be noted that only a known proportion of native families ever does produce export commodities. For instance in Handeni out of 7,000 possible cotton growers, only 2,000 planted as advised and they received an average return of £2 per head. In the Pares about 2,500 reacted out of 8,000 possible, and many received from £2 to £3 per head. Figures showing a similar trend are available from other cotton growing areas in the Eastern Province.

With reference to coffee growing, it has been observed that because a native grower on Kilimanjaro receives on the average about £3 for his crop, that return is compared with a year's pay which the grower could earn were he

to work on a coffee plantation. Only about one-third of the native taxpayers on Kilimanjaro grow coffee, namely 13,000. There thus remains a large number who do not grow the crop and they are available for other work. Further, coffee is not the only source of income to the Kilimanjaro native, nor are his coffee plantations yet fully developed.

Attention is drawn to the opportunity of increasing the export of pulses. Butter beans, field peas, gram, pigeon peas and cowpeas are suited to most areas. Good field peas grow best at the higher altitudes. The home market for this crop* is mainly supplied by Russia and Japan, and the crop can be regarded as a profitable one for both European and native enterprise. With beans, such as Madagascar butter beans, Tepary and Ohtenashi beans, a very high quality is essential if a footing is to be obtained in the home market. In the first instance these are more suitable crops for European production, as grading by machinery and careful hand-picking of discoloured and defective beans is essential. There are good, less discriminating markets in Eastern Africa for the lower priced pulses such as gram, and cowpeas. Pigeon peas are capable of wide production both for the overseas and the local markets; trials are being made with early maturing types in an endeavour to secure a uniform product. An increase in the production of pigeon peas is also to be desired from the cultural point of view, as it is an excellent deep rooting plant which breaks up the hard pans too commonly produced by the present methods of peasant cultivation and which reduce the yields of both food and economic crops to a greater extent than is generally known. (In the same way the deep soil-aerating effect of the cotton plant on the heavier soils is no small factor in an increase in yield of rice and maize especially.)

Sugar is produced on a small scale, and the common jaggery is all consumed locally. Enquiries are more frequent concerning the suitability of land for cane growing on a scale large enough to meet the needs of the Territory.

Cashew nuts may be found growing in various areas near the coast; other countries find this a valuable crop, and the possibility of extending production is being considered for this Territory.

Cassava.—This starchy root crop was planted extensively as a stand-by against grain crop destruction by locusts, and, in some instances, as an inter-season food-crop. Cassava is now obtainable in large quantities and the possibility of the export of cassava starch should be seriously considered.

Potatoes do well in the Ulugurus, Usambaras, Kilimanjaro and Meru. Whilst an increase in the production has been achieved, imports from abroad still continue.

The work of education and demonstration of anti-erosion methods, of lay-out and cultural methods has proceeded steadily in conformity with the policy of the department. In Mwanza generally and to a lesser extent in other areas the simple adjustment of the *mtuta* to the contour mentioned in the last report has been effected. Examples of terraced and other systems of anti-erosion lay-out may now be met with in most areas.

Cover cropping has gained in popularity and in practice, and the system of lining cultivated plots with pigeon pea or manyara, in the areas subject to

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* Common field peas as grown in the Usambaras are reported on as being of excellent quality, good flavour and to cook quickly. Current value £12 per ton c.i.f. compared with £10 5s. for Russian. Sorting to remove small and immature peas would enhance the value.

wind erosion is slowly gaining ground. As these simple small scale methods gain in general adoption, Native Authorities should be the more ready to establish continuous and extensive wind-breaks in pasturage.

Late planting of cash crops mentioned in the last report seems to be an almost ineradicable trait. Some people will learn only by experience, and then do not apply the knowledge gained.

Crop estimates, particularly from native areas, are not easy to make, and it is difficult to separate the effect of enthusiasm from the estimates sent in. Measurement of a number of plots taken at random multiplied by the total number of plots found in a district does give a reasonably accurate figure for acreage. Estimated yield averages from the random selected plots vary with the experience and enthusiasm of the observer. Estimates current in commercial circles show extremes of variation equally as great as those from official sources, but as a system is evolved, close estimates to an accuracy of ten per cent. above or below actual should be possible. It should be noted that the period May-May gives a more nearly real reflex of the season's production than January-January, as there is a carry over of crop during the first four months of the year.

Marketing.

Extended reference to this subject was made in the last report and administrative action was taken in many places to rectify one or more of the disabilities mentioned. There appears to have been little or no disturbance of trade by the application of cash marketing, and but little disturbance where concerted marketing or selling through an organized market was carried out. There remains the problem of the distant or detached community offering little surplus because of the paucity of marketing facilities. The native producer was more satisfied and in course of time "retail" marketing by individual natives is certain to resolve itself into "group marketing." As soon as native groups are reliable enough to keep their bond and make their deliveries up to the declared quantity the system will extend.

The Kilimanjaro Native Co-operative Union at Moshi has organized a sound marketing system for its coffee which has the advantage of enabling the coffee grown by its members to be separated as to the ridges from which the coffee comes. Furthermore, the onion crop is now being marketed steadily over a period of several months in the year and the soundness of the produce is now ensured by means of departmental inspection.

The situation in Bukoba regarding the condition of coffee offered for sale and exported, mentioned in the report for 1931, was tackled by means of inspection before export, and there has been a considerable improvement in the cleanliness and dryness of the coffee exported. The rules make inspection compulsory whilst very simple grading or sorting is optional. About ninety per cent. of the total is exported under a grade, but grade certificates are not essential to the trade at present. As soon as the exporter realized the value of inspection, which he was not slow to do, he did his best to co-operate and make the process of inspection easy and with some traders almost superfluous. There have been several cases of the inclusion of large stones in bags of coffee which are difficult to detect with the trier, and in the case of three consignments only has mustiness been reported from Mombasa. An amendment to the rules has been made which will, it is hoped, facilitate the detection of foreign matter. It is advanced as evidence of the success of the system that

no claims on Bukoba deliveries have been brought to the notice of the department this year, but in view of the steadily rising market for Bukobas throughout the year, this does not mean very much. What is more important is that with some little exception the trade is more satisfied, and direct sales overseas are now being made from Bukoba. It is understood that London principals are not fully satisfied as to the need for grading, but local opinion, and the department is serving the local industry, is unanimously for it, supported by the opinion of many Mombasa merchants.

Agricultural Shows.

Native agricultural shows are held from time to time at district headquarters in Mwanza Province where they appear to be popular. A more ambitious show embracing trade exhibits is being organized by the Administration in 1933, which should be of value and help to the Province.

Agricultural Education.

Apart from the numerous instructors who are trained for work in the field by individual officers, and the demonstrations accorded by the experimental and native authority seed farms, and instructors' gardens which are formed, planted and kept in such a way as to provide local demonstrations, there is a need for the *training* of young Africans in agricultural work reinforced by *training* in handicraft. Natives can be *trained* and it is trusted that for some years at least "Agricultural Education" will mean not education so much as *training*. The Coffee School at Bukoba will be essentially a training institution. It is hoped to have native apprentices on the Kilimanjaro Coffee Station. There is no idea of saving money or securing cheap labour by the apprenticing of natives to training at schools and experimental farms, as from personal experience, it is considered that the average trainee costs more to maintain and train than he is able to produce in any one year.

Local Production for Local Consumption.

The local market is being increasingly supplied from local sources. An import of maize has been replaced by an export in excess of previous imports. Onions, potatoes, rice, coffee, all show a reduced importation. Vegetables are being more largely produced for the local markets.

Such ghee as is being imported is in the nature of a luxury, this being buffalo ghee from India, which cannot be produced in the Territory. Tobacco imports are being displaced in part by material from local and East African sources. Generally speaking the Territory is becoming more self-supporting.

Pests and Diseases.

The locust invasion mentioned in the last report continued throughout the year: the Lake, Western, Iringa, Central and the Northern Provinces being mainly affected. Action was successfully taken wherever possible to reduce the hopper bands. In the Eastern Province and Tanga there was a moderate infestation and baiting was resorted to with success. Zinc band trapping proved effective also.

A very great deal of work was done by native people and a considerable amount of time and energy was put into the campaign by officers of the department and those seconded by other departments.

This department cleared an area in Kenya, from Taveta to Rombo, and north as far as Maktau; the anticipated reciprocal action by the authorities in Kenya in the Loliondo section of this Territory did not eventuate, and the flying form of the pest invaded Mkalama.

Special mention must be made of the effective work done in the Northern Province, where a trench many miles in length was dug across the convergent paths of the hoppers and enormous numbers were there slaughtered. In Rungwe also, officers did excellent work. The success or partial success of these anti-hopper activities has brought home to the native the fact that, if directed, he is able to surmount what hitherto appeared to him to be a hopeless situation.

In Shinyanga, in addition to the normal locust work, on one occasion practically the entire population together with all government staff turned out for a three-day campaign with most effective results. There is much to be said for getting over with a campaign in this fashion.

Expenditure was kept well within bounds, and an enormous amount of hopper destruction was effected at low cost. Some flying swarms were destroyed, especially in the Mkalama and Iringa Districts. The destruction of crops by locusts fortunately was nowhere disastrous.

In the Mwanza Province considerable areas of cotton were infested with "Leaf crinkle" associated with cold rainy weather and White Fly. This caused considerable damage to the crop.

Rodents.—The Kilosa-Kimamba area suffered from an invasion of field mice and there were reports of damage from near Turiani and in the Rufiji Valley. Better crop sanitation of all cultivated areas plus a delay in bush burning and the burning of a belt of grass round a settlement, before general burning is carried out elsewhere, are measures likely to reduce or delay the damage done by the pest. Early planting and early picking of cotton is recommended, as a means of avoiding loss to a large extent. Baiting, whilst effective in destroying numbers of rats, is insufficiently effective over a wide area to be employed as an exclusive measure. The protection of predators on rodents is suggested, and rat hunts may be organized. Unfortunately the local "terrier" is no "ratter".

Scientific Work.

The purely scientific staff remains small in numbers, namely: two Entomologists and one Mycologist. Scientific investigation in the Territory is reinforced by co-operation with Amani workers, where the subject is of general importance to East Africa, and the help of Amani in several directions is gratefully acknowledged. The reports of the scientific officers will be found as annexures to this report.

The Entomologist remained the whole year in the Northern Province and worked on coffee pests and their control. Measures against Antestia received especial attention. The success of the triple strength spray for this pest seems to depend very much on the human factor, together with climatic influences. *Anthores* or White Borer was the other major pest dealt with; re-infection studies were undertaken and a large scale demonstration was made, showing the effectiveness of a small borer gang working over the plantation steadily in rotation throughout the year, thus reducing the percentage of infestation and checking re-infection. The migration of Borer Beetles from the bush to the plantations formed part of the study, which is not yet completed.

The Assistant Entomologist was stationed in Morogoro during the earlier months of the year, when he concentrated on beeswax production and rat destruction. During his leave he lectured on Tanganyika bees and their habits and exhibited specimens of wax and honey. He also enquired into the requirements of the British market as regards beeswax. In addition he took numerous specimens of rats, with their parasites and stomach contents and made careful enquiries regarding modern rat control methods.

The Mycologist stationed at Morogoro, in addition to his normal research work, gave demonstrations to numbers of natives showing the value of simple seed dressings against smut, which causes loss of food crops. He visited the Northern and Tanga Provinces and spent seventy nights in the field away from headquarters.

Experiment Stations.

REPORTS FROM THESE STATIONS ARE ATTACHED.

Eastern Province, Morogoro.—In addition to the continuation of trials mentioned in the last report, special attention has been given and will continue to be given to cotton selection and the isolation and multiplication of good strains. Collections of local and other varieties of bananas, cassavas and sorghums have been made. Work on citrus varieties on different stocks is under way, and a successful technique was worked out for coffee grafting and budding. A success of about ninety per cent. with the latter can be recorded which should go far to help to solve a number of problems in coffee work.

Tabora-Mwanza, Lubaga.—On the experimental station new store buildings and a small cotton laboratory were built during the year with funds found from the Cotton Cess. The station adjoins the large Native Authority farm and is close to district headquarters. The soil is richer and heavier than that at Ibadakuli, being comparable with the land now being reclaimed from tsetse infested bush, which land will in future be more extensively cultivated by native people.

Cotton and groundnuts are the two crops to which special attention is given, cotton experiments were seriously interfered with by pests in 1932.

Ukiruguru.—This Native Authority farm is near Mwanza, and a portion has been set aside, about 35 acres in extent, which, together with a small two-acre rice garden in Mwanza Town, will serve as a sufficiently large station for the study of "Lake Shore" agriculture. The need for this was mentioned in my last report and it is satisfying to record that the station has been established.

Mpapura.—This station is situated midway between Lindi and Mikindani. It is now mainly concerned with demonstration with cotton, tobacco, sesame, sorghums and pulses. The trials are not carried out with a view to obtaining significant data, hence the detailed report is not published.

Visitors.

The Head Office was visited during the year by thirty-eight unofficial visitors.

Official visitors included the late Sir Sidney Armitage-Smith; Dr. Mann; the Comptroller of Customs; the Provincial Commissioner, Eastern Province; the Conservator of Forests; and the Chief Veterinary Officer.

Publications.

The following pamphlets and leaflets were issued by the department during 1932 :—

Pamphlet No. 6.—"The Migratory Locust", by W. V. Harris, Assistant Entomologist.

Pamphlet No. 7.—"Coffee Cultivation with special reference to the Northern Province, Tanganyika Territory", by F. R. Sanders and A. J. Wakefield.

Pamphlet No. 8.—"Further Observations on Factors in Arabica Coffee Culture", by F. R. Sanders and A. J. Wakefield.

Entomological Leaflet No. 11.—"The Mosquito Blight of Tea", by W. V. Harris, Assistant Entomologist.*

In addition a number of short articles on topics of local interest were contributed to the press.

During the year legislation was passed dealing with marketing and with coffee curing and treatment. Further, the department is identified with two advisory boards which were set up by Government during the year, namely : the Economic Advisory Board and the Railway Advisory Council.

Collaboration and contact with officers serving in Kenya, Uganda and at Amani was extended during the year, and consultations with Agricultural Departments in Kenya, Uganda and Zanzibar were more frequent.

The organization of the department has remained unaltered during the year. Notwithstanding measures of economy such as the withdrawal of subsistence allowances, the staff has actually travelled considerably more than in previous years and particular attention is drawn to the fact that the average number of *nights* District Agricultural Officers have been absent from their stations and their houses, working in their districts is exceptionally high. There are instances of over two hundred nights being spent on tour.

Again it is desired to record the enthusiasm and loyalty displayed by the staff during the year, and to remark the measure of assistance accorded to them by their brother officers for which our best thanks are due.

NOTES ON THE CHIEF EXPORT CROPS.

Cotton.

In 1932 the progressive decline in production mentioned in the report for 1931, was arrested and a largely increased outturn was secured, except in Lindi Province where production was again small. In Tabora there was an increase in production. In the greater part of the Shinyanga District an issue of U/4/4/2 seed was made, that variety having proved suitable in a semi-arid area, but an unusually heavy rainfall had an adverse effect on yields.

In the Mwanza Province a very great increase in the area planted and cultivated was remarked, but adverse conditions which included flooding and heavy and continuous rains inducing "White Fly" and leaf crinkle, reduced normal yields by fifty per cent. so that in spite of the greater area planted only a small increase in total production over that of last year can be recorded.

In the Eastern Province, although non-native production fell off, the output of cotton was almost doubled. Mahenge Province contributed a small crop, for which a ginnery was erected, and considerable increases in the amount of seed cotton produced were recorded in the Bagamoyo and Rufiji Districts.

* For mycological publications see report of Mycologist, page 76.

In the Tanga Province, where cotton growing had languished, a special effort was made with the result that production rose considerably, and native people are now satisfied that cotton is a good crop to grow.

Estate production, which is confined practically to the Eastern Province, was reduced on account of the rather poor outlook regarding prices, fear of rat damage and the general financial stringency. Those who had faith enough to persevere, reaped no inconsiderable harvest, and even the moderately good prices and the increased output for 1932, have altered the attitude of planters and also natives towards the crop.

All is not well, however, with the industry, there are anomalies regarding the prices paid for the different qualities of seed cotton. The planter, because he sells in bulk and can bargain successfully, often receives far more for ungraded seed cotton than does the native for his sorted and superior first quality seed cotton. Native people are not slow to note this adverse differentiation, but they are forgetful of the fact that by "selling retail" through an expensive marketing system, they must of necessity be penalized, and they are not yet sufficiently educated to appreciate the sanctity of a contract which might be unfavourable to them on a rising market.

The Cotton Cess devised as a means of paying for seed and for market supervision is paid only on native cotton; that this is inequitable is realized and it is hoped that it may soon be abolished and something less particular and equally effective be put in its place.

Motor Transport.—Native cotton growers now expect, as a matter of course, that a motor lorry will come as near as possible to their huts in order that their seed cotton may be conveyed to market. It is a service which has to be paid for heavily; because the owner must accompany his cotton to the market or buying post to sell it, and the tonnage of seed cotton which may be carried per trip is much reduced. It is anticipated, however, that this service will induce natives to plant larger plots of cotton and thus increase individual production. The cost of such transport is deducted from the price paid to the native at the markets, thus causing further dissatisfaction over prices. As transporters travel long distances up to eighty and ninety miles away from a market, looking for cotton sellers, and then return past several buying points to their market of origin and finally are obliged to take the native sellers back to their homes, the cost must be out of all proportion to the value of the seed cotton. It will be necessary to devise a plan whereby such uneconomic transport may be checked, and the freedom of the seller preserved. Actually an allowance of three cents per kilogram was permitted to buyers by financiers and ginners in the Eastern Province to cover transport cost, with a consequent reduction in the price paid for native cotton almost everywhere. It is not surprising that prices are disproportionately low. Several methods of checking or overcoming this are feasible, such as native group marketing and the zoning of transport areas round markets.

The main difficulty which faces the cotton industry is the fact that such a small crop has to carry excessive equipment in buyers, transporters, ginners, ginneries, stores, licences, anti-plague measures, and all the devices which appear to have grown up round the crop. The most potent cure is to treble production, concurrently eliminating excessive charges, and creating a lively local interest instead of the detached interest which is prevalent.

As this report is compiled prior to the completion of the season's ginning, it is not possible to give the completed figures for lint production, but in the following table approximate figures for 1932 are given based on the seed cotton production figures for the year which are also given :—

Province	1929	Lint in pounds 1930	1931	1932 approx.	Seed-cotton in pounds 1932
Eastern ...	6,982,400	5,291,182	1,566,834	2,729,313	9,097,710
*Tabora ...	98,000	111,800	51,858		
Mwanza (Lake Province) ...	3,012,800	3,325,489	2,752,630	2,847,660	9,492,240
Lindi ...	784,800	371,541	63,058	15,504	51,686
Tanga ...	127,199	68,500	67,765	619,560	2,065,271
Northern ...	† 70,800	† 52,650	† 37,613	50,520	168,443
Bukoba ...	38,090	33,104	873	—	—
TOTAL ...	11,114,089	9,254,266	4,540,631	6,262,557	20,875,350
Bales ...	27,785	23,135	11,351	15,656	

* Shinyanga, the cotton area of Tabora Province, is now incorporated in the Lake Province.
†Includes a portion of the Pares, Tanga Province production.

Non-native production for 1932 is estimated at 1,229 bales (of 400 lbs. each), about 8 per cent. of the total production as compared to 16 per cent. in 1931, and divided by areas as follows :—

Kilosa District	970 bales.
Morogoro District	109 ,,
Northern Province	52 ,,
Lake Province	34 ,,
Tanga Province	30 ,,
Lindi Province	19 ,,
Dar es Salaam and Bagamoyo Districts ...	15 ,,

The greater portion of estate grown cotton is produced in Kilosa District where conditions were slightly better than in 1931 with the result that there was an increased production of 400 bales. In previous years cotton has been largely interplanted with sisal, but with the reduction of new plantings of sisal and the number of estates now derelict, particularly in the Morogoro District, estate production is greatly reduced. The decline in production is notable when compared with 1930 during which year 5,888 bales were produced.

The sales of seed cotton by natives during the 1932 season are shown in the following table :—

Area	Seed-cotton (Native) in pounds 1st	2nd	3rd	Total	Value Shs.
Morogoro ...	2,781,657	700,274	82,077	3,564,008	282,612
Kilosa ...	1,627,923	330,891	372,055	2,330,869	188,930
Rufiji ...	445,106	14,196	101,818	561,120	41,759
Bagamoyo ...	964,579	35,024	97,532	1,097,135	82,528
Dar es Salaam	70,859	1,522	14,982	87,363	7,093
Mahenge (Kiberege)...	278,169	—	37,517	315,686	22,060
Lindi ...	19,432	655	3,143	23,230	2,294
Northern Province ...	66,372	2,174	30,457	99,003	7,517
Tanga ,, ...	1,538,879	114,598	371,474	2,024,951	140,158
Lake ,, ...	7,003,665	2,442,932	—	9,446,597	724,153

The range of prices paid in the various areas shown in cents of a shilling per kilogram is given in the following table :—

Centre	2st Quality		2nd Quality		3rd Quality	
	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum
Kilosa ...	25	18	14	12	7	4
Kimamba ...	25	18	14	10	5	4
Ruvu ...	25	18	14	14	5	5
Bagamoyo ...	25	18	14	12	6	5
Kilimani ...	24	16	12	12	9	5
Ngerengere ...	25	18	14	12	7	5
Morogoro ...	30	18	14	12	12	5
Mikese ...	25	18	14	12	7	5
Shinyanga ...	22	15	12	8	6	4
Milola (Lindi)	24	24	14	14	9	9
Handeni ...	18	15	—	—	9	7
Pares ...	19	16	—	—	9	8
Moshi ...	21	18	—	—	10	9

Cotton Advisory Board.—The Board has functioned with success and is giving considerable help in evolving a policy which it is hoped will tend to remove existing anomalies. Although its members are drawn from and represent various interests, there is considerable unanimity as regards its decisions, which encourages the hope that differences amongst the buyers, ginners and growers are not insoluble.

Coffee.

The exports for 1932 show a rise in tonnage of 2,111 and a rise in value of £216,560. This rise in tonnage is mainly due to the increase in the Northern Province Arabica production where biennial bearing is experienced. The carry-over into 1933 is expected to be about 800 tons, mainly in the Northern Province. Low prices were recorded at the beginning of the year but fortunately there was a significant rise before the bulk of the crop came to market, but prices again fell slightly towards the end of the year.

In the Bukoba area, there is still much misgiving over the more delicate and difficult Arabica or "Plantation" crop, but it is hoped that by means of constant demonstration and advice and with the effective influence of Native Authorities and the Administration, the plantings will be saved and restored to vigour. In this connection it is pleasing to record that there was a decided alteration in the attitude of Native Authorities towards the main asset of Bukoba, its coffee. The Administration has been active in supporting propaganda for betterment and towards the close of the year an administrative officer was seconded for duty in Bukoba, with especial reference to coffee work.

The Robusta or "Native" crop was good, and when one considers that by the application of inspection, much of what passed as coffee in earlier years, does not now leave the port, the increase is all the more significant.

As a result of inspection and grading at the port, there has been a general improvement in the preparation of his crop for market by the grower. The drying of coffee on raised stands is now becoming the rule and not the exception, and greater care is being taken over the hulling. The system of grading particularly since June, when grading was made optional, has worked smoothly and well, and it is more than doubtful whether the trader would now dispense with the system. Difficulty is experienced with the "Ngadashe" or second crop of the year which is small and lacks boldness, and hardly grades up to the standards of the main crop.

The following are the figures for grading and inspection at Bukoba from the date of inception in April to December :—

Number of Bags	Graded			Inspected		Total passed for export
	G. A. Q.	F. A. Q.	Triage	Passed for export	Rejected	
of 200 lb. of Arabica	263	10,107	1	2,386	419	12,757
of 200 lb. of Robusta	—	55,336	—	4,535	5,342	9,871
					Total ...	72,628

On Kilimanjaro, the condition of native coffee plantations shows improvement, and greater interest is now being taken in anti-erosion measures and the use of cover crops. The practical investigations carried out by the staff, under the direction of Mr. A. J. Wakefield, have undoubtedly aroused interest of the right sort, and now that some of the reasons for crop failure are better understood, it is hoped that the industry in the Northern Province will be placed on a sounder footing, and that new plantings will not be injured by injudicious cultivation and treatment following the former empirical methods.

Actually it is felt that planters in the Northern Province and elsewhere who have unprofitable, deeply planted and heavily root pruned coffee, should consider uprooting and replanting on contour, or with steep slopes on a terraced lay-out; as such action would lead to an earlier rehabilitation of the estates. Unfortunately the parlous financial state of many non-native planters, and the fact that in the eyes of the mortgagee to uproot old coffee would lower the value of the estate, prevents any really widespread and active steps towards rectifying the general condition.

During the year in consultation with Native Authorities and the Administration, a policy in regard to native coffee planting of Arabica coffee was drawn up, the need for which was mentioned in the last report.

The newer coffee areas of Babati, Oldeani, Dabaga, Mufindi, Tukuyu, Mbeya and Mbosi were visited and examined during the year and advice tendered to planters after careful consideration had been given to the applicability of ideas derived from experienced examination in the Northern Province.

Oldeani shows great promise, and with the exception of a few plantings, provided care be taken to avoid the cultural errors of the past, the plantations should prove profitable. There is room and need for extension of the area of this settlement.

Babati presents a more difficult yet a not insuperable problem. Considerable development has been undertaken and with guidance a coffee industry can be established.

In Tukuyu, coffee is said to be a failure and is being replaced by tea, but the condition and bearing of old uncultivated native coffee trees indicates that coffee should not necessarily fail. Especial cultural methods are necessary in this particular area which has its own peculiar problems.

In Mbosi and Mbeya, it is known that good coffee can be produced, but here again the enthusiasm of planters and their desire to get in big acreages without a prior investigation of the kind of culture suited to the local conditions has led to certain losses. These are not great, however, and it is considered that barring prolonged drought, coffee can be established and maintained on

a profitable basis. Costs of realization must be reduced nevertheless. Fortunately the quality of the coffee produced in these areas is high.

Of coffee in Dabaga and Mufindi, it is difficult to write with any confidence and, without much care and study such as those people who have ventured in these areas are able and competent to devote to it, it is difficult to see that the coffee crop will flourish. Existing coffee plantations should, however, soon reach the condition when definite conclusions can be reached. In the Usambaras no appreciable extension of planting has occurred and the production of good quality coffee has been maintained as in former years.

The investigations on irrigation water and soil alkalinity in Arusha have been brought to a point when publication is possible, but certain problems remain awaiting solution. There has been close co-operation with Amani on this matter. It is pleasing to note that indiscriminate, wasteful and actually harmful methods of irrigating coffee are steadily giving way to a more rational use of water.

Studies in connection with coffee problems continuously engage the attention of staff in the coffee areas, and it is safe to say that a sufficiently large number of observations have been made to enable sound practical advice on culture to be given, however much the explanation for such advice may vary from that of current scientific opinion; and much controlled experimentation is necessary to test out many of the conclusions and ideas which have been evolved from the observations made.

The estate for a coffee experimental station has been bought and plans for the lay-out of buildings and part of the estate have been drawn up. Building will commence in 1933 and the development of the estate should proceed during that year. A major problem which confronts the coffee investigator is the provision of standardized planting material which is essential to experiments to give reliable data; preliminary work has been started, and Mr. T. H. Marshall, Senior Agricultural Assistant, has achieved promising results with the vegetative reproduction of coffee, both by budding and grafting.

The figures for production in the chief coffee areas in 1932 and the two previous years were :—

Area.	1930 Cwts.	1931 Cwts.	1932 Cwts.
Bukoba	147,380	131,720	142,143
Northern Province	65,820	49,480	77,360
Usambara District	4,140	3,760	4,780
Iringa Province and other areas	—	—	2,957

The total exports and estimated values of estate and native coffee in 1930, 1931 and 1932 were as follows :—

	1930		1931		1932	
	cwts.	£	cwts.	£	cwts.	£
Estate ...	67,540	165,309	41,320	81,269	63,097	159,213
Native ...	163,400	231,731	143,700	165,768	164,143	304,384
Total ...	230,940	397,040	185,020	247,037	227,240	463,597

Tea.

No new tea areas are being opened up but development continues in Mufindi and Rungwe. The visit of Dr. Mann was much appreciated and his

report is awaited with interest. However, he gave sufficient information to planters and the department locally to enable development to proceed with safety.

The Usambaras appears to be a very promising area, provided measures are taken to control soil wash from the commencement of opening up.

Unfortunately the state of the tea market generally coupled with financial conditions, will continue to exercise a retarding effect on tea development. Notwithstanding this, the department is assisting practically by the provision of tea seed, or alternatively assisting in the importation of high grade tea seed. In addition, an officer skilled in tea culture is employed in the tea areas in Iringa Province; a second officer with practical tea planting experience was stationed in the Usambaras areas.

The greater proportion of the present low output is consumed locally.

Sisal.

Production again shows an increase. Prices have fluctuated but have been very low indeed. For only a short period did sisal touch £18 per ton, the average being about £14 10s. This spells restriction in planting of new areas, although a few planters are setting out new blocks.

There is some tendency to join up the transport systems of estates in order to utilize existing decorticating machinery to its fullest capacity, and consideration is being given to an extension of this system along the Central Line.

Whilst prices are so low, it is idle to expect an advance in methods of cultivation on any scale, but growers are not unaware that there is room for trial and investigation, and a keen interest is now displayed in cover crops and their use in sisal culture.

The matter of sisal grading referred to in the last report has come up for consideration, and up to now no alteration in the present estate method has presented itself. Surprise visits of a check grader might be of assistance in bringing staff on the smaller estates up to the mark, but as things are, and as the recovery end of the business is organized, there is but a remote possibility of carrying out a sound and acceptable grading scheme.

The project for a sisal experiment station is still in abeyance, although there is much to be learned from investigation in a sisal area. An alternative crop or crops which could be cultivated either with or as alternates to sisal is desirable: this may be found in Manilla in some areas. Improved recovery in the plant is a crying need, and further grouping and regrouping of estates may serve to reduce costs. Field observations on the behaviour of the sisal plant under different conditions have been started.

Although tonnage increased by nearly 5,000 tons, the total value of the crop exported in 1932 was only £698,202 as compared with £707,177 in 1931. The following are the figures showing the exports for the last three years:—

Area.	1930 Tons	1931 Tons	1932 Tons
Tanga	37,827	38,113	40,487
Morogoro-Kilosa-Dar es Salaam	7,813	9,866	11,052
Lindi and Mikindani	4,100	6,242	7,240
Moshi	159	1,718	1,775
Other areas	63	—	—
Total ...	49,962	55,939	60,554

Tobacco.

The production of fire-cured leaf for local manufacture into shag or cigarettes is increasing but the production of Turkish is not expanding as mentioned in my last report.

The Tobacco Station at Iheme was equipped during the year and should serve the Iringa Province for some years.

Some good Turkish cigarettes have been manufactured from a blend of locally produced leaf. The need for baling fire-cured tobacco in grades has been stressed, and the necessity for flue-curing a brighter and lighter tobacco for cigarette purposes has been brought to the notice of planters.

The fire-cured native crop shows an increase in production. Local markets are likely to absorb the output for the next two years.

Groundnuts.

In 1932 the production of this crop, despite adverse conditions in several producing areas, was brought back from an export total of 3,070 tons for 1931 to nearly 16,000 tons in 1932, so that the hope expressed in the report for 1931 has been fulfilled. In most areas this crop was declared a cash crop and prices were fairly good. The crop was variously estimated at from 22,000 to 25,000 tons, a figure which should have been reached, but Tabora produced only a half crop and the Central Province less than that.

Production is likely to increase in 1933. As groundnuts and groundnut-oil are being used increasingly in the diet of native people, and as the crop has valuable soil ameliorative power in addition to being rarely affected by locusts, it might with advantage be included in the food crops list.

Copra.

The tonnage produced for export seems to be stationary in amount, and most of the copra exported finds its way to Zanzibar. The following table sets out the exports for the past three years :—

Area.	1930 Tons	1931 Tons	1932 Tons
Tanga-Pangani	2,972	2,119	1,573
Mafia	1,619	4,627	4,805
*Dar es Salaam and Bagamoyo	2,455		
Kilwa-Mikindani-Lindi ...	349	488	887
Total ...	7,395	7,234	7,265

* Includes Rufiji.

Attention is devoted in increasing measure to the improvement of the health of plantations and the preparation of copra from the nuts. Kiln drying, so very desirable, will be adopted but slowly by the owners of small plantations.

Sesame.

This crop shows a slight increase in output. There is an idea prevalent that sesame is not a crop to encourage, but whilst there is a market for this oil seed, it savours of folly to neglect it, especially as sesame oil is largely used locally in the culinary art. The export figures for the crop are as follows :—

AREA.	1930	1931	1932
	Tons	Tons	Tons
Lindi-Mikindani	2,106	2,327	3,108
Mwanza	435	335	160
Kilwa	414	514	862
Other areas	160	649	681
TOTAL ...	3,115	3,825	4,811

GRAINS.

The Territory exported 11,737 tons of rice, maize and millet valued at £89,849 during 1932. This shows a slight decrease in quantity but an increase in value of over £10,000 as compared to 1931.

Rice is sold mainly to Uganda and Kenya and the prosperity of those dependencies is a very important factor in the export demand. During the year the suspended duty of Shs. 2/- per cental was imposed as polished rice was being dumped at prices which would have seriously affected local production, without any countervailing advantages. The following are the export figures for the three main grain crops :—

CROP.	1930	1931	1932
	Tons	Tons	Tons
Rice	4,556	4,754	5,385
Millet	1,814	5,270	3,529
Maize	192	1,769	2,823
TOTAL ...	6,562	11,793	11,737

OTHER CROPS AND PRODUCTS.

Beeswax.—The collection figures for this commodity show a decrease, due to two factors, namely : increased production of annual crops and also the effect of the drought of 1931 in the main collecting areas. Water supply throughout the year has a very important bearing on the strength of bee-colonies, and therefore on wax accumulation.

Greater care is now being exercised by native collectors to clean the wax before offering it for sale, and it is highly desirable that they do not mix various coloured waxes. It is trusted that it will be found possible to impose a standard on the product, which, if satisfactory to the market, will raise the domestic or f.o.b value of our wax exports. Much more could be done to collect wax from areas in which bees abound.

Gums.—The collection of this commodity shows an increase, large quantities may be produced from the dry highland areas of Tabora, Mwanza and Central Provinces. Small quantities of gum copal are sorted out of the mass of gum collected and this quality finds a ready market at a high price. Pale or white gum is exported to India for culinary purposes, but this is a low-priced commodity. A considerable proportion of gum collected is unfit for export because of discoloration and dirtiness. There should be some method of clarifying the waste and of making it marketable.

Kapok.—The production of this fibre shows an increase, and the seed which contains a high percentage of oil is again saleable.

Cinchona bark from the Usambaras, if well sorted, brings a remunerative price.

Fruit.—Citrus fruit and stone fruits are marketed in adjoining countries. An attempt has been made to export mangoes, of which we have several kinds of high quality. Egypt refuses entry, whilst delivery in Britain is attended with considerable waste.

Dried bananas, well packed, are being sent abroad in increasing quantities from the Handeni District.

DETAILS OF ASSISTANCE AND PROGRESS.

North-Eastern Circle.

Northern Province — Tanga Province.

The staffing of this Circle remains the same as explained in the report for 1931, namely: one Senior Agricultural Officer at Moshi with five District Agricultural Officers at Arusha, Kilimanjaro, Moshi, Lushoto and Tanga respectively, and two Agricultural Assistants on Kilimanjaro.

Weather conditions have been good except in the Western Usambaras where precipitation was below normal. A vast amount of work of an important developmental nature has been carried out in this circle and everywhere the interest of the planter and the native has been maintained and increased, especially with coffee.

A successful effort was made to resuscitate the cotton crop in the Pares and Handeni, where conditions were good, but where the crop had gone practically out of cultivation. The full benefit of cotton growing is only dimly realized by native people, and it is trusted that each year will see increased enthusiasm for it.

The Coffee Advisory Board has been reorganized and instead of individual representatives for areas, members are now nominated by planters' associations. The Director of Amani has consented to join the Board and it is hoped that representatives in an advisory capacity will be selected by Kenya and Uganda. From the members of the Coffee Advisory Board, a Board for the control of the new coffee experiment station will be selected. It is gratifying to note with what unanimity planters, both non-native and native, were prepared to submit to a cess on coffee production to provide the interest and sinking fund on the capital cost of the station. In 1933, it is hoped to have the station partially developed and a commencement of lay-out and a few experiments should be started.

The sisal experiment station projected for the industry made no progress during the year, the land even not having been secured. It is strongly recommended that the industry again consider a very small export cess of possibly not more than 10 cents per bale for its establishment. Sisal brokers, or London merchants might, in their own interests, consider whether it would not be a sound investment to make a move with Government in the direction of establishing this very important and necessary station. Without help from the industry coupled with the guidance of those concerned in it, the department feels that it should not embark on a project so intimately connected with sisal estate management. However, time is passing and a move must be made soon.

Advance can be recorded in connection with the copra plantations on the coast and it is understood that they are slowly regaining condition. The action taken in several native areas, to prohibit nut collection save during known and fixed harvesting periods has narrowed down the period during which thieves may operate with comparative impunity.

Attention is drawn to the large undeveloped alienated areas which are available for development in the Tanga Province, and further the abandoned rubber areas, situated as many are on good soil and near water, offer scope for enterprise through reclamation. In Tanga, development is not at a standstill because of lack of land or even of opportunity. No further remarks are called for, a perusal of the report of the Senior Agricultural Officer, Northern and Tanga Provinces, printed herein, will reveal in more detail the work which has been done, and provides more information regarding conditions in these provinces.

North-Western Circle.

Lake Province: *Mwanza-Bukoba* — *Western Province*: *Tabora-Kigoma.*

This is a very large circle with a large and industrious population. The staff under the Senior Agricultural Officer, Mwanza, consists of two District Agricultural Officers and three Agricultural Assistants for the old Bukoba Province; four District Agricultural Officers and two Agricultural Assistants for the Mwanza Province and one District Agricultural Officer for the old Tabora Province.

The year has been marked by an intensive locust infestation and by bad weather conditions in the Lake Shore areas of Mwanza, where so much is usually produced. Fortunately the extensive areas planted, although producing what amounts to half a crop as checked by experimental station and district figures, maintained the normal production for the province, thus proving I think conclusively, that the most potent method of evading famine and poverty is to plant at least twice as much as formerly, or in other words, to work twice as hard.

The Mwanza Province provides a striking example of the value of team work, directed to combating the ills to which agricultural districts are prone, locusts were checked by strenuous efforts on the part of the people and government officers, and cultivation was extended largely as a result of the enthusiasm of all parties.

Steady development is taking place throughout the area and in due course the native family will become possessed of the means of managing properly and effectively much larger areas of cultivated land than it does at present. As soon as this stage is reached, reclamation of tsetse infested bush will automatically expand as the people will undoubtedly spread. The gradual adoption of ploughing as a means of cultivating a larger area and of getting it sown within the optimum planting period is certain to have a profound effect on the prosperity and habits of the people. It will, however, be a matter of gradual development and no spectacular increases in activity through the adoption of ploughs may be anticipated for some years.

Experiment farms.—There are now two of these, Lubaga and Ukiruguru, not particularly well equipped as yet, but they should grow in usefulness as they are developed. They each adjoin a large Native Authority seed farm, over which supervision can be exercised, and it is trusted that in time the Native Authority farm will be developed as an agricultural training centre.

Native Authority farms in other areas, Kwimba and Mwasitta, are not joined to experiment farms, but are seed raising areas mainly. It has been the work of a year or two to curb the enthusiasm for seed farms which could not be much better than failures, because of the very little supervision which could be exercised. In the place of these numerous small seed farms, we have established small demonstration plots which cost little and yet can show each year the few things we desire the native to learn.

It is unnecessary to do more than refer to the work being done in the development of Musoma, where gradually the Administration is opening up an area of decided possibilities, which in time should add much to the wealth of the Lake Province. The report of the Senior Agricultural Officer, Mwanza, is printed herein and reference to that report will show in greater detail the efforts of the department and the progress of agricultural work.

South-Eastern Circle.

Lindi Province.

During the year the provincial administrative boundaries were extended by the inclusion of Songea District in the Lindi Province, and the circle organization now covers the same area, instead of two provinces as previously. The staff consists of a Senior Agricultural Officer at Lindi, District Agricultural Officers at Lindi, Masasi and Songea and an Agricultural Assistant at Mikindani.

The rains were earlier than usual and uneven in distribution, with severe drought in January. Grain crops were in general late planted and as a result, yields diminished. Economic crops such as sesame, cotton and groundnuts, which are planted later in the season were not affected by the drought, and it is depressing to record that this rich area of the Territory shows very poor results in export production as compared with other parts. Sesame shows an increase of a thousand tons but against this there is a decrease in millets of fifteen hundred tons. Rice and groundnut exports decreased and cotton was negligible, ten tons being produced. Copra shows decided improvement, double the tonnage being exported as compared with 1931.

Efforts are being made to encourage greater production in 1933 and it is hoped that the cotton crop may be resuscitated as in the Tanga Province. A good quality of fire-cured tobacco is being produced by the natives and it is marketed under the auspices of the department. Whilst considerable time has been given to this production by the agricultural officers the output is still small, seven tons being marketed.

A summary of the Acting Senior Agricultural Officer's report is included as an appendix to this report.

The following provinces and districts have no circle organization, they come directly under the head office of the department so that in effect the Director acts as the Senior Agricultural Officer for these areas :—

Eastern Province.

During the year the province has been served by one District Agricultural Officer stationed in Kilosa, for the Kilosa and Kilombero areas; one District Agricultural Officer at Morogoro; one District Agricultural Officer in Dar es Salaam, who with the part time assistance of an Agricultural Assistant stationed at the Dar es Salaam Botanic Gardens, works in Bagamoyo, Dar es Salaam and Mafia; and one District Agricultural Officer in the Rufiji who works into the Morogoro District up to Kissaki.

In the Bagamoyo and Dar es Salaam Districts, and generally throughout the province, the rains were late in starting but were up to normal in quantity. On the whole, crops were fairly good; some little damage being done by locusts, and by rats in Kimamba, Kilosa and Rufiji. Flooding by the Rufiji River which rose over nine feet caused much loss of crop.

In the Bagamoyo District, the output of cotton, which is the chief native cash crop, was much increased, the season having been good with an absence of pests. Thirty-nine tons of seed were issued and this produced 498 metric tons of seed cotton showing the very high percentage of 87·8 of first quality, and an increase of five and a half times over the production of 1931. The average price paid for first quality native seed cotton at all posts was 20 cents per kilogram.

Copra is produced by both native and non-native planters, and during the year a steady effort was made to put the plantations into a better state of sanitation, but much remains to be done. The quality of copra produced by the native is very inferior due to using unripe nuts, carelessness in drying, and the absence of a premium in the price for better qualities. Types of kiln driers have been erected in Dar es Salaam by the department for demonstration purposes.

In Dar es Salaam, non-native planters are chiefly concerned with sisal production, and the cost of recovery of this fibre has reached a very low level. Very little cotton was produced by the native although twenty tons of seed was distributed. There seems to be no reaction in this district to any propaganda entailing personal effort.

The department maintains the Botanic Gardens, and the War Graves and provides large numbers of trees, bushes and plants for avenues and gardens in Dar es Salaam, its environs and numerous up-country stations.

In Mafia Island copra is the main product. The condition of this industry is deplorable. Two million trees are said to be growing on the island, and the average surplus from both native and non-native blocks is one kilogram of copra per tree. Over-crowding, theft, too early harvesting of green nuts, bad preparation and poor prices all have their depressing effect. Leaf-wilt is prevalent as also is gummosis.

In the Rufiji District, despite a better effort on the part of the people, the crop results for the year are depressing; increases being shown only in copra and cotton, the latter giving a return three times greater than in 1931. It seems perfectly clear that the resources of the valley are not being fully exploited by the native inhabitants.

In the Morogoro District, plantation work was not very active, several sisal estates planted a few years ago are now derelict. The finance for equipment simply cannot be secured.

Some planters maintained cotton production and reaped satisfactory harvests, whilst native people increased their plantings and were fortunate in being able to sell their crop at moderately reasonable prices.

This district with the adjoining Kilosa District would well repay development and is not handicapped by being an excessive distance from the port. On account of the fact that land may be found at altitudes varying from 1,200 to 5,000 feet, there is the possibility of a very diverse production. In many places the land, though patchy, is quite rich; unfortunately, water supplies are not too well distributed and the bush is infested with fly. Notwithstanding these adverse factors, the area is undoubtedly attractive.

Planting material is distributed from the Experimental Station, Morogoro. Potato and vegetable growing is being helped in the higher areas. Further planting of coffee by individuals is taking place, and experimental blocks of Criollo cocoa have been started by the department.

In Kilosa, quantities of improved seed were distributed, demonstration centres showing contour-ridging and anti-erosion lay-out have been established; groundnuts have been encouraged as an early crop, and the practice of inter-planting green gram with cotton is gaining ground. Rice production with bulk seed supplies of a better and uniform variety, Faya, has been encouraged. Coffee is being tried by planters and by some natives and more interest is being taken in the production of better quality tobacco. Onions are produced in quantity by one planter and some natives, and there are distinct possibilities for sugar production. Given anything like normal seasons with present prices for everything save sisal and grains, which are on the low side, there would appear to be a bright future for the district. Kilosa is the natural outlet for produce from the Iringa and Mahenge Provinces.

Iringa Province.

The province is staffed as mentioned in the last report.

Weather conditions in Iringa and Mufindi were good whilst in Rungwe heavier rains than usual were experienced especially near the Lake Shore where flooding took place.

The Iheme tobacco station was further developed during the year, and the District Agricultural Officer and the Agricultural Assistant for the northern portion of the Iringa Province are now resident on the station which adjoins a large area reserved for the future Native Authority farm. Although Virginia and Turkish tobacco are the main lines of work, which are prosecuted by the staff, planters are advised generally on other crops: temperate climate small grains, feeding of cattle and pigs, fruit and deciduous fruits generally. Advice on tea is given by the District Agricultural Officer, Tukuyu. Tea and tobacco appear to be the most promising economic crops for the Iringa District as these can best bear the high cost of transport to the railway.

Heavy Western tobacco.—The production of this crop rose in 1932 from 10,000 to 85,000lbs., practically all of which was sold to the local tobacco manufacture in Dar es Salaam, but it was ungraded. In 1933, the buyer will purchase on grades only. *Valuations made by brokers in London of a three-pound sample of Iringa fire-cured ranged from one shilling per pound for grade 1 to sixpence per pound for grade 3. Bales of graded leaf have since been sent for a more reliable valuation to be made, which should give some idea of the possibility of export from plantations.

Turkish tobacco.—With the cheaper and easier Virginian crop as an alternative, the present production of Turkish will tend to decrease: three tons only was produced this year. Last year's crop of 8,500lbs. was fermented in the small magazine at Iheme. Good cigarettes made from this leaf are now on sale locally. A variety trial of Turkish was carried out at Iheme, and this work will be continued with a view to the selection of better types.

Coffee.—This crop has been extensively planted in Dabaga, Mufindi, Mbosi, Tukuyu and several other small areas. In the Dabaga and Mufindi areas five-year-old coffee is hardly yet bearing, and the advice given hitherto

* Since this valuation, further consignments have been forwarded to Europe and realization is awaited. Prices are, however, lower and 10d. for No. 1 is probably the present value.

to proceed cautiously has been shown to be sound. Many planters in suitable areas have gone into tea, as being a crop more likely to respond to the conditions. Mbosi, Mbeya and to a lesser extent Tukuyu, are promising and with a better understanding of coffee culture, and the preparation of crop, there is every hope of its successful establishment and development. A tour of the coffee areas was made by Mr. A. J. Wakefield, to examine the growth and to explain the advice given in the pamphlets on coffee issued this year; with special reference to conditions as found and as described by planters and officers.

The Tukuyu coffee crop will require the use of driers and, owing to the high transport cost, hulled coffee must be exported from the Tukuyu-Mbeya-Mbosi Districts.

It is also important that the method of dealing with the expanding native coffee crop of Tukuyu be brought up to date, as the spectacle of natives pounding partially dry coffee in mortars in the streets of Tukuyu, in order to sell their small crop (about eight tons) of clean coffee to the fifteen licensed Indian coffee buyers is not particularly pleasing, nor is the practice sound.

Tea.—Dr. Mann visited many areas in Iringa Province in company with Mr. R. M. Davies, District Agricultural Officer, who is responsible for tea work in the Iringa Province; with the result that planters in the Mufindi and Tukuyu areas are maintaining, if not increasing, their interest in the crop. The factory for Mufindi should be constructed during 1933.

It is unfortunate that the many possible side lines, and mixed farming for which Iringa Province appears suitable, cannot be developed largely on account of transport distances and charges. A flour mill has been erected in Dabaga in which district wheat can be grown, the bacon factory has, however, ceased to function.

Native agricultural effort in Iringa Province apart from the coffee grown in the Rungwe District is mainly concerned with food crops. The increasing demand for foodstuffs in the Lupa is met by native effort mainly. The development of the Lupa may be fraught with important consequences to the whole province, and native people will benefit largely if a permanent and extensive market is created. An enormous variety of crops can be grown.

Central Province.

Staffing remains as indicated in the last report; but the African Instructor staff has possibly been reduced too far.

The Manyoni-Singida-Mkalama area is inhabited by somewhat conservative tribes interested mainly in cattle, and grain crops for food, such as millets and sorghums, whilst maize is a luxury. They have interesting agricultural practices, and manage to grow their millets with the minimum of effort, a system, born of long experience, being followed in different districts.

Groundnuts appear to be the only sound export crop at present, but attention is paid to beans and peas and rice also. Root crops like cassava and sweet potatoes are being encouraged.

These districts suffered severely during the year from locusts and a short drought. In almost any year the production of the necessaries of life will absorb the greater portion of the agricultural effort of these people, there is, however, every chance of an appreciable surplus for sale, especially as the

price of cattle has fallen so low. There are three substations and four school gardens in these three districts; in addition, seven demonstration plots were established in the Singida District.

In Dodoma native people are definitely evincing an interest in crops other than "Uwele", which was the crop of the district. In many villages rice, maize, beans, gram and peas are being tentatively tried by the people, whilst in other villages and especially near swamps a greater variety of crop is becoming the rule.

Groundnuts are being developed and some natives are becoming vegetable growers.

In Kondoa people appreciate the value of the groundnut crop, and although these districts do present a somewhat arid spectacle, there are large areas with possibilities which can be developed only by the native as his needs increase and his inclinations are drawn that way.

Erosion of soil both by water and by wind is a serious factor, every river is a "sand" river, but steps are being taken by Native Authorities to preserve the bush cap of the numerous hills and ridges. It is easy to trace the progress of cultivation from the river banks over the river benches to the foothills. Gullies and bare patches mark the trail almost everywhere. Wind erosion is most serious, and temporary and permanent wind breaks are essential to the preservation and possible recovery of much of the land. The realignment of the mtutas or cultivation-ridges to the contour appears to be more generally practised.

There are several tribal farms which serve as demonstrations against erosion as well as providing seed for issue. The use of kraal manure and its preservation before use are also demonstrated. Further, the effect of paddocking and resting the veld to permit natural grasses to regenerate is most marked. In some areas, Native Authorities understand this and are taking steps to allow portions of their districts to have the essential rest from the constant tramping and grazing to which the land has long been subjected.

As in Mkalama and Singida, locusts were prevalent, and especially near Mpwapwa damage was done. On the whole the hopper campaigns were effective save in the vicinity of Mpwapwa, where slackness was apparent. Army worm, too, damaged crops early in the season.

MOROGORO,
24th January, 1933.

E. HARRISON,
Director of Agriculture.

ANNEXURE I.

ANNUAL REVIEW OF THE NORTH-EASTERN CIRCLE

(Northern and Tanga Provinces)

FOR THE YEAR 1932.

1. The policy was maintained of concentrating effort over those areas of greatest agricultural potentiality, and it was possible to bring the very promising and attractive settlements of Oldeani and Babati in the Mbulu District into the active sphere of the District Agricultural Officer, Arusha, and the new outlook made it possible to do work of real benefit to the Pares. The assistance given to the planters of the Taveta (Kenya) area has been continued. It has been quite impossible with the present staff to meet all the requirements of District Officers, and planters also.

2. The number of visitors to the Moshi offices, and not including the offices of the Entomologist or other districts was in the neighbourhood of one thousand, requests for advice and personal discussion of agricultural and marketing matters being widely sought by planters and the commercial community generally. Two parties of Kenya coffee growers paid a visit to Moshi to discuss the various aspects of coffee culture under local conditions.

3. Official visitors to the North-Eastern Circle included : Mr. E. Harrison, the Director of Agriculture, on five occasions, who toured practically every area of economic importance, and discussed on the spot with associations and individual planters those matters of major importance especially with regard to marketing, legislation, and provision for experimental work. The Soil Chemist, and the Physiologist of the East African Agricultural Research Station, both spent long periods in the Northern Province in connection with their work, the Botanist carried out a botanical survey of the Coffee Experimental Station ; the closest collaboration has been generally maintained with Amani. Dr. Martin and Mr. Beckley, Agricultural Chemists respectively of the Uganda and Kenya Departments, visited the coffee growing areas of Kilimanjaro. Dr. Mann, now Director of Woburn Experimental Station, toured the Eastern Usambaras to report on the tea prospects of that area, and also visited the coffee areas of Kilimanjaro ; no officer can speak too highly of the advice and guidance given by Dr. Mann. The Mycologist, Morogoro, also carried out an extensive and valuable tour of the North-Eastern Circle. The Provincial Commissioner, Tanga, visited Moshi with the District Officer, Same, to discuss marketing and to see methods of native coffee culture and the organization of the Kilimanjaro Native Co-operative Union ; later the District Officer, Lushoto, with several Usambara chiefs visited Moshi to attend a demonstration on native coffee growing. This interchange of visits has been most helpful to our work.

4. The journal published in Arusha has been of valuable use in bringing the work of the department to the wide notice of the public. Lectures have been frequently given and papers read to meetings of planters whose associations have co-operated in this work ; the lectures have been at the especial request of planters themselves, the attendances at these meetings and the discussions which followed the papers indicate the keen desire for a better understanding of the problems which confront the planter at every turn.

5. No more pleasant observation can be made than in referring to the cordial relations which have existed between officers and the planting and commercial community; we are indebted both to planters' associations, chambers of commerce and to individuals for advice and constructive criticism which has been sought by us and given by them in most helpful degree.

Weather and Rainfall.

6. Both the total precipitation and distribution of the long rains (late March to mid-May) was favourable throughout the Tanga and the Northern Provinces for crop production generally, with the exception of the Western Usambaras where the total rainfall was below normal, rains are here expected also in August, usually sufficient for the planting of maize and beans, but this year they failed. The short rains (November to December) were much delayed and broke only in mid-December.

General Remarks on Crop Production.

7. Despite the vital importance of marketing, of finance and of the world depression on the production of crops, if a long view is taken of the conditions affecting the prosperity of the Territory, there is no doubt that as far as the highlands are concerned, soil-erosion overshadows all other factors even though the latter may be quicker in their effect. We have stretching from Tanga to Arusha and on to Oldeani near the Ngorongoro crater, a stretch of highlands unrivalled throughout the Territory for its inherent fertility. But in the endeavour to develop its potential resources, the impatience of man can very rapidly destroy these with little reward for either the cultural effort or the expenditure of capital which is involved. Already the steeply sloping sides of many of the valleys are deeply gulleyed and the subsoil and rock is exposed over large areas where forest grew a few decades ago. The reduction of the forest and trees continues with cutting for domestic fuel supplies, and by burning to produce early grazing in the forest glades (the Masai are the chief offenders here). The native generally hoards his wealth as stock; severe erosion is caused by cattle and goats (especially on the north-eastern slopes of Kilimanjaro, in Mbulu and in the Western Usambaras); the wealth produced by such crops as coffee enables the native to purchase stock, also science and quarantine organization have made such headway against disease that the increase in the stock population has long outstripped the native's capacity to manage both it and the soil at the same time. Stock has long been the backbone of British farming; stock in Tanganyika is fast rendering many areas incapable of being farmed at all, and it can be said that until the native adopts better methods of animal husbandry, then tsetse fly may be something of a blessing for the future welfare of the tribe. The Chagga tribe of Kilimanjaro are the nearest to the ideal: their cattle are mostly stall-fed with grass carried long distances daily from the plains up to the more densely populated mountain slopes; this is wasteful of labour, however, and edible canna has been introduced as a stock food (it will also provide a reserve for human consumption); also it is hoped that certain cover crops will prove suitable for the necessary soil cover in coffee capable of being cut and fed to the stalled cattle, the manure being returned to the soil each day.

8. With the high rainfall and steep slopes of the Usambaras, of Kilimanjaro and of Arusha, cultural operations alone, and especially with irrigated eleusine on Kilimanjaro, have caused serious loss of surface soil. Numerous demonstrations of various anti-erosion measures now exist from the

coast to Mount Meru, and a response to the propaganda and work of the past two years is slowly becoming evident : over a hundred native coffee planters on Kilimanjaro have voluntarily contour-hedged their plots and several have formed terraces ; a large storm drain was dug at one village as a demonstration, the natives willingly turned to the work and would accept no payment. An increasing number of natives seek instruction, for example, 188 growers were assisted in one month on Western Kilimanjaro alone, but we are still only on the fringe of this vast problem ; nevertheless within five years at the most, no native or European cultivator need be ignorant of the ways in which soil-wash can be stopped, and it will be then that, if no substantial progress has been made, legislation could be justly enacted to preserve the land for future generations. The cost of terracing for coffee is only Shs. 50/- per acre. Mr. Harvey has made models and is preparing a diorama illustrating the various anti-erosion methods ; it is a method of instruction which is well appreciated by the native cultivator.

9. Perhaps that part of the structure of the plantation industry most in need of repair is finance. Most of the commitments were incurred during the years of high prices for sisal and coffee ; and planters with the optimism of the boom period developed vigorously and sometimes unwisely. Profits went into further development and no reserves were built up. Properties changed hands and land values advanced to a high level. Finance was competitive and some planters are now but unpaid managers of their estates. It is obvious to all that a rationalization of the planting industry is essential both for the welfare of the producer and his backer. High prices for staple products may enable high interest charges to be met, but a drop to low prices (which now appear to be more or less permanent) has made a radical change. The position can be summarized as follows :—

(i) If foreclosure is made, there is bound to be a loss, for the land values of several years ago cannot be realized now.

(ii) If maintenance advances are stopped the value of the security rapidly declines.

(iii) If bare maintenance advances are continued, as at present, with no provision for development, in all probability the value of the security declines, gradually at first but with later increasing rapidity.

10. There is a fourth choice to the above, and that is a change from the all-too-prevalent attitude of *laissez-faire*, to a more confident and constructive policy of development to the extent that is within the productive capacity of the soil. Mistakes in culture, which are inevitable in early planting efforts without prior experimentation, should not have an undue pessimistic influence in deciding the future policy of plantation finance ; cultural errors with coffee are simple yet of permanent serious harm, they need never be repeated and there are examples of coffee estates of high annual yield which leave one in no doubt as to the suitability of soil and climate of our present coffee areas. Where coffee has been severely damaged by cultural errors, there is no doubt that replanting the whole over a period of five years would pay well in the end, and would not be an expensive measure as revenue either from the old or the new plantings would always be coming in.

11. The sisal problem is definitely one of world economics which, however, forces the planter to a review of the cultural side. If development is stopped with sisal the position will be very serious. The life of the plant and the

essential need for production of quality, should leave no doubt as to the wisdom of providing for the future, and there are firms who are confidently going ahead and these should reap the reward they deserve.

12. Extension of the coffee areas occurred in the Arusha District and at the new settlements of Babati and Oldeani. All sisal development ceased in the Arusha District. An important irrigation scheme was constructed in the Moshi District for the production of maize, rice and sugar.

13. In dealing with development, the Eastern Usambaras of high rainfall call for comment. There is comparatively little development here, and vast estates of ten, fifteen and twenty thousand acres mostly of virgin forest are lying idle. Dr. Mann examined the area closely, and was favourably impressed with its prospects for tea. Cardamons grow wild, and there are possibilities for this high-priced spice especially in view of the restriction by disease of the areas under cultivation elsewhere; plants and seed of the Mysore and Malabar cardamons have been distributed for trial. Cacao does well in the lower more sheltered valleys, and trials are being made to determine suitable localities for extension of this crop. Robusta coffee thrives well, and with recent investigations on Arabica coffee it is by no means certain that the area is quite as unsuitable for this crop as previously considered. Quinine bark of high quality has also been produced.

14. With native agriculture, the call for more production has been splendidly answered. To avoid any interference with labour supplies, no campaign for increased native production, other than foodstuffs which were plentifully supplied, was carried out in the main plantation areas; and near isolated estates, administrative officers, chiefs, the people themselves and the plantation managers were all consulted to obtain an equal distribution of individual with estate effort. The main crop concerned was cotton, and in the Handeni District, production was raised from 25 tons in 1931 to nearly 500 tons of seed-cotton for the season 1932 and in the Pares from 90 to nearly 450 tons and from 5 to 40 tons in the one or two villages of the Moshi District where cotton will grow. This was achieved by unselfish team-work between the administrative officers and the district agricultural officers concerned; it meant continuous touring over extensive areas during the rains: the most trying part of the year and the most difficult for travel. It meant that areas such as the Pares, which although served by a railway, have never yet served that railway to any appreciable extent, made some contribution towards the general recovery: at one remote village, which has previously produced little or nothing, Shs. 5,000/- were paid out in one day. Where currency notes and a few odd shillings were placed before many of the native sellers in payment for their cotton, they took the latter but would have left the notes if their attention had not been called to them. They had not seen such wealth before and had no idea what the paper money represented. £3,500 was paid out to natives in the Pares and £3,500 in Handeni, of this £1,500 and £1,000 would probably be utilized for tax payments and most of the balance will be spent in the local village stores; so that the good effects of the campaign to trade generally will not be felt for some months.

15. Yet the results are not regarded as satisfactory. Some 6,000 natives in each area took cotton seed and prepared plots, but many put off planting through one reason or another until the optimum period for sowing was well passed and little or no yields were obtained with the late-sown cotton. If the Agricultural Officer could have visited every area during the restricted period

for optimum planting, then production would have been much greater. With the vast areas to be covered, however, this was a physical impossibility, and some scheme is needed to augment the supervision necessary at planting time, in order that, through procrastination, the native will not lose the benefit of the work already done in clearing and digging.

Marketing Improvement and Extension.

16. Methods of marketing and distribution of staple products have lagged far behind production : while we have grain, cotton, hard fibres, etc., saleable only at very low prices often representing a loss to the producer, there are millions in this world who subsist on a minimum of food and are poorly clad. There is little if any difference in the costs of marketing produce now and with the high prices previously obtained ; the railage on a bag of maize for export is Sh. 1/12, the price which the planter is offered to-day is Shs. 4/- to Shs. 5/-, thus railage to the coast alone takes about 25 per cent. of the gross returns. Marketing on a co-operative basis is often denied planters by their financial commitments ; even were it possible, it is unlikely that it would be followed with such a product as the higher qualities of Arabica coffee, although the lower qualities could well be so disposed of. The Usambaras planters for some time have had under consideration a scheme for co-operative marketing for all their products ; a co-operative society with twenty-three European members has been formed, each with a share capital of Shs. 250/- ; it is proposed to erect a central store and cooling rooms in Tanga ; a contract has been secured for supplying Dar es Salaam with a regular consignments of potatoes each month. It is ever a long jump from the price realized by the producer to that paid by the consumer.

17. These problems are always in the mind of the planter, who is impotent to achieve little, if any, readjustment. Nevertheless, the problem of marketing and of distribution has received constant attention and, it can be claimed, with some local improvement. All available avenues of marketing have been explored for many products, and unseen avenues have been sought. In this respect, it is encouraging to note the increasing interest that is being taken by merchant houses in the northern part of the Territory ; during the year two principal directors of large distributing merchant houses have paid personal visits to the Northern Province from England, and they were so impressed with its future possibilities that they mean to return and maintain the contact they have established. Definite advantages have already accrued from these visits to both their firms and the local producer, and it may be possible in the near future for the whole of the native coffee crop, for example, to be sold before even it is picked ; new markets for less valuable products are likely to be a further outcome.

18. Products for which information has been requested by potential buyers, or markets sought on behalf of the producer, include : beans, field-peas, Telfairia nuts, banana "figs" and chips, beeswax, essential oils including petit-grain oil, chillies and spices generally, onions and potatoes, oranges (for the home and local market), pineapples, wheat, soya-beans, and maize ; it is, however, difficult to see what can be done to aid the maize grower. The importation of sound maize grain only is now permitted, such grain must satisfy the conditions of the Kenya grade K2 ; the importation of maize which is unfit for human consumption is entirely prohibited. Following the campaign started in 1931 for a more loyal support of local plantation industry, there is a real desire on the part of the public to buy Tanganyika produce.

19. Trial consignments to Dar es Salaam of vegetable and dairy produce from Arusha failed mainly owing to the high costs of transport and port handling charges. Through booking is required before any volume of trade will exist between the Northern Provinces and the Central Line. A parcel post at special rates for agricultural produce would be a great boon.

20. Figures were given in the last annual report showing that with the better qualities of coffee the marketing charges amounted to about twenty per cent. of the gross proceeds, while with the lower grades it amounted to thirty-five to forty per cent. Coffee auction markets have been successfully instituted at Nairobi, and facilities have been given by the Kenya Government allowing coffee from the Northern and Tanga Provinces to be sold at Nairobi; this avenue is useful for the disposal of the lower grades, the better grades usually being sold on the London market. The prices obtained both locally and on the London market for Arabica coffee are still good, and producers can consider themselves as highly favoured when compared to other industries and to the prices ruling for other staple products.

21. With the reorganization of the native coffee growers of Kilimanjaro into a corporate body, divided into sixteen sub-societies on accepted co-operative lines (now called the Kilimanjaro Native Co-operative Union, Limited), under the guidance of a European manager and completely independent of Government except in so far as the supervision required by the Co-operative Societies Ordinance, 1932, the past marketing troubles have disappeared. Local sales at Moshi were well patronized by buyers and prices from Shs. 38/- to Shs. 52/50 per hundredweight of uncleaned parchment coffee were realized; Shs. 65/- was realized for three cleaned parcels on the Nairobi market. Other consignments were sent to London through various channels (Shs. 75/- for A to Shs. 64/- for C were realized for the only consignment for which particulars have come through). So far, the Kilimanjaro Native Coffee Union, Limited, has given its members an average net price of just under 40 cents per pound for its local sales alone, as compared to 27 cents which was the average price realized in open competition by over twenty buyers last year. Then in contra-distinction to last season when there were serious and well-founded complaints of damp and musty coffee, the product placed on the market this year is excellent for dryness and purity, due to the strict control given at the society's buying centre, where admirable arrangements are now in force easily capable of dealing with sixty tons of parchment, delivered in small lots, per day. All inferior coffee is purchased and marketed separately from the good stuff. A recent consignment cleaned at Kilindini gave an outturn report of only 17 per cent. loss in cleaning and with 84 per cent. of A grade. The Meru native coffee was sold by tender.

22. Both in Handeni and the Pares, including Moshi, the ginners for each area have a virtual monopoly of the cotton crop. The Moshi ginners agreed to pay the same prices as paid by the Morogoro ginners under fair competition, less the bare cost of railage from the Pares to Moshi, which, to give a uniform price for the whole of the Pares, was averaged at two cents per kilogram; this has given intense satisfaction to all concerned and if good climatic conditions are experienced a further large increase in production will result next year. In Handeni, however, the usual sliding scale was followed, based on Liverpool futures three months ahead, to guarantee minimum prices (when American middling futures stood at fivepence the minimum price seed-cotton was 15 cents per kilogram with an increase or decrease of two cents for every rise or fall

of fifty points per pound). At the beginning of the season seed-cotton was marketed in three qualities, but a quick change was made to purchase by two qualities only. The following are the prices obtained in cents per kilogram :—

District	First Quality		Third Quality		Average
	Lowest	Highest	Lowest	Highest	Price
Handeni ...	15	20	7	10	14·7
Pares ...	16	20	8	10	15·8
Moshi ...	18	22	9	11	16·7

23. Two or three years ago onions to the value of £2,000 were imported annually : these imports have practically ceased to Moshi, but over 80 tons to a value of £750 were imported into Tanga. Kilimanjaro native-grown onions have been exported by merchants and by the Kilimanjaro Native Coffee Union, Limited, to Mombasa, Nairobi and Uganda ; the produce was favourably received and enquiries have been made from Uganda as to the possibility of an agency for increased consignments. A simple measure of inspection has been instituted by the department to insist on proper ripening and careful drying. Last year, for the first time, maize was exported equal to the large amounts previously imported ; despite low prices this export was maintained and imports through Moshi and Tanga were negligible ; for the first time also, Northern Province maize has been quoted on the Nairobi market. Native-grown wheat in small quantities has also been exported for the first time ; an up-to-date wheat mill is also in operation at Arusha. Oranges in large amounts are sent to Kenya from the Muheza District. Greater interest has been generally displayed and more attention given than formerly to our lower grade products, as well as coffee, by East African firms. The Western Usambaras suffer most from the existing inadequate marketing channels, and no progress will be made there until something is done to supplement the present meagre facilities.

Crops and Cultivation in Detail.

24. *Sisal.*—The following are the amounts of sisal fibre exported during the past four years :—

Province	1929	1930	1931	1932
	Tons	Tons	Tons	Tons
Tanga ...	34,542	36,480	38,113	40,487
Northern ...	1,560	1,659	1,718	1,775
Total ...	36,102	38,139	39,831	42,262

The value of the 1932 output is approximately £500,000 as compared with £1,180,000 in 1929.

25. The above amounts were shipped through the ports of Tanga and Kilindini as follows :—

Port	1929	1930	1931	1932
	Tons	Tons	Tons	Tons
Tanga ...	35,313	37,728	39,552	41,686
Kilindini ...	789	411	279	576
Total ...	36,102	38,139	39,831	42,262

26. Sisal fibre, in common with most raw materials, is still being sold at considerably under the total cost of production. The present selling price for No. 1 sisal is £14 c.i.f. European ports which means an average of approximately £12 15s. over all grades. The average pre-war price was £28 10s.

Plantations have only been kept working by the most drastic reduction of salaries and wages and by the abandonment of replanting, cleaning and other essential services.

27. Efforts are being made in many directions to expand the uses to which sisal fibre can be put. The most important extension so far is its greatly increased use for parcelling twines and string. The manufacture of bags from the lower grades is a definite outlet for part of the production. There seems to be little doubt that the sisal bag could compete, in Africa at least, with the jute bag as regards costs and particularly in regard to quality.

28. The main reason for the present ruinously low price of sisal is due to the economic dislocation of world trade, which has particularly affected raw materials. It does not appear to be due to any cause arising out of the industry itself such as excessive over-production as in the case of rubber. It should be remarked, however, that at the rate that development was proceeding prior to the slump, and if normal times had continued, over-production would certainly have occurred. No development, on any appreciable scale, has been done for three years, and it is unlikely, even if times improve, that there will be any substantial increase in production for many years.

29. Theoretically, it would appear feasible for all producers to agree to restrict supplies and so improve the price but this would mean that the other producing countries, Java and Mexico, would have to agree. Attempts made by the industry in this direction have shown that there are too many irreconcilable interests to permit any hopes of success for a general scheme of restriction or marketing organization.

30. At present there are no indications of any improvement in the sisal position in the near future. The chief consuming countries are America and Canada, and it is to the economic position of these two countries that attention should be directed for any change in the position. The East African sisal planter is thus compelled by circumstances beyond his control to continue maximum production, reducing his costs wherever possible and improving his grades.

31. Efforts are being made by the Tanganyika and Kenya Sisal Growers' Associations to establish standard grades for East African sisal. This should assist sales in the world markets in competition with other countries.

32. Little improvement has taken place during the last few years on the mechanical side of the industry. The decorticator, the most important item of machinery on an estate, even in its latest form still wastes a serious amount of the fibre it treats, varying from 10 to 20 per cent. or more according to the type of machine and its condition. Drying and brushing the fibre is still largely a matter of hand labour rather than machines. Transport has advanced with the introduction of suitable locomotives and trucks. Any further development is definitely checked owing to the stringent financial conditions of the present time.

33. On the cultural side there has been practically no advance since sisal was first planted in Tanganyika some thirty years ago, and information is badly needed on the growth of the sisal plant with especial reference to factors influencing yield, poling, colour of fibre, tensile strength and texture of the fibre. It is extremely difficult for the Agricultural Officer to carry out any work with sisal until an experimental station with laboratory equipment is provided.

34. Two years ago the matter of cover crops in sisal was brought to the notice of sisal growers who, however, were doubtful of the practicability of the system with sisal. Nevertheless, trial plots of several kinds of cover crops were put down, as a result of which there is an increasing interest and one estate has now twenty-five acres under *Crolataria usaramœnsis*. *Dolichos hosei* has also shown great promise, and it has the advantage of growing from cuttings. The indigenous *Crolataria invantulensis* has continued with much success on the lava ash soils of the Moshi District and about 300lbs. of seed of this has been collected for extensive trial over the coastal sisal areas. Seed was also sent to Lindi and Morogoro and to Kenya for trial.

35. In addition to cutting down the cost of upkeep, cover crops which are deep-feeding should eradicate those weeds which compete with the surface roots of the sisal plant, these also are less liable to mechanical injury when under cover crops. It is possible that both yield and the life of the plant may thus be prolonged; field trials are being laid down to determine this. In co-operation with Amani, and the Amboni Sisal Estates, Limited, trials have been carried out with treating salted-sisal by centrifuging with various quantities of pure water (for economy of fresh water when ample supplies of this may be lacking) with, however, as yet inconclusive results.

36. It is of interest to note that the owner of a comparatively new estate has avoided the large capital outlay which a factory requires by running a trolley line from his plantation to a neighbouring factory for decortication. One wonders if this is the beginning of central factories as outlined by Mr. E. Harrison, the Director of Agriculture, about eighteen months ago.

37. *Coffee.*—The production of coffee in the Northern and Tanga Provinces is practically all of the Arabica type, with negligible amounts of Robusta in the high rainfall areas of the Eastern Usambaras, and in the Nguu Hills of the Handeni District. The first consignments of coffee from the Oldeani area and increased amounts from Kiru, Babati, were marketed this season. Prices were excellent in the early part of the year, and at the beginning of the present season Shs. 80/- to Shs. 95/- per hundredweight were realized with good first quality coffee; but with an easier political situation in Brazil, and the competition of heavy crops of mild coffees from other countries, prices fell to below Shs. 75/- in late November. The following are the amounts of parchment coffee exported over the past four years from the various areas :—

District	1929 Tons	1930 Tons	1931 Tons	1932 Tons
Arusha ...	785	1,418	838	1,329
Moshi ...	1,113	2,674	1,636	2,539
Usambaras...	144	207	188	239
TOTAL ...	2,042	4,299	2,662	4,107

38. The above amounts were shipped through the ports Tanga and Kilindini as follows :—

Port	1929 Tons	1930 Tons	1931 Tons	1932 Tons
Tanga ...	1,499	2,498	1,265	1,509
Kilindini ...	543	1,801	1,397	2,598
TOTAL ...	2,042	4,299	2,662	4,107

The increasing proportion of exports railed to Kilindini since 1929 is mainly due to the facilities given there by the local coffee cleaning and curing works.

39. The amounts of (A) estate (non-native) and (B) native parchment coffee produced for export over the past three years are as follows :—

District	1929 Tons		1930 Tons		1931 Tons		1932 Tons	
	A	B	A	B	A	B	A	B
Arusha ...	754	31	1,373	45	805	33	1,285	44
Moshi ...	573	540	1,918	756	1,073	563	1,506	1,033
Usambaras ...	144	—	207	—	188	—	224	15
TOTAL ...	1,471	571	3,498	801	2,066	596	3,015	1,092
GRAND TOTAL	2,042		4,299		2,662		4,107	

40. Arabica coffee of the Northern Province generally has the biennial bearing habit (there are some estates and plots of native coffee which bear heavy crops annually) and the above figures do not give the true indication of this as the marketing season extends from August to March ; the carry-over from 1929 is low, that of 1930 high and so on. The approximate seasonal crops in tons of parchment coffee are as follows :—

1929/30 Tons	1930/31 Tons	1931/32 Tons	1932/33 Tons
1,920 ...	4,800 ...	2,100 ...	4,300
(40 per cent.)	(100 per cent.)	(42 per cent.)	(89 per cent.)

41. *Estate Coffee.*—In 1924 the exports of Arabica coffee (in parchment) amounted to 1,579 tons, there was a steady increase to 2,614 tons in 1927 ; exports then remained comparatively steady until 1930 when the record figure of 4,299 tons was achieved. As stated above, much estate and non-native coffee has now fallen into a condition of biennial bearing amounting to a general yield in the off-year of only 40 per cent. of the on-year ; the full extent of biennial bearing is hidden by new plantings as they come into cropping for the first time. Hence if individual estates are taken the position is often much worse : six estates were taken at random and their average yields of parchment coffee per 100 acres of mature coffee are as follows :—

1929 Tons	1930 Tons	1931 Tons	1932 Tons
5 ...	27 ...	3 ...	21
(19 per cent.)	(100 per cent.)	(11 per cent.)	(80 per cent.)

42. This cannot be regarded as satisfactory : it means that the cost of production is doubled, including mortgage charges and living expenses as well as of the costs of cultivation and measures against pests and diseases. It is a matter of grave concern to planter and financier alike and one that must be faced before ever the industry can be placed on a sound footing. As will be described below, it is considered that biennial bearing should not be a normal feature of either Arabica coffee or the general conditions under which it is grown in the Northern Province, but that it has been induced by cultural errors that, as simple as they have been, are more or less permanent in their harmful effects. That the soil and climatic conditions of the Northern Province, with some local exceptions, are very favourable to the production of Arabica coffee, can be seen with several blocks of estate coffee and many native-owned plots at different altitudes which have borne heavy crops regularly every year, some with an average as much as 11 hundredweights per acre of parchment coffee. Biennial bearing is practically always associated with over-bearing and die-back in the on-year (in one season an estate which marketed 18 tons of parchment had 10 tons of "buni"). In most cases the cause is due to the inability of the plant, mostly through deep-planting and severe root damage, to utilize the soil fertility which is there. Replanting is the only

remedy with extreme cases of biennial bearing, such as those cited, where over-bearing and die-back occur; if one-fifth of the area is done each year, revenue will always be coming in, and finally one should be left with a plantation giving annual bearing and one where costly measures against pests and diseases, of which many are induced by cultural errors together with biennial bearing, will not be so necessary.

43. Unless the facts are faced, and replantings made with care taken to preserve the soil against erosion and to avoid past cultural errors, then there are many estates that can never carry their present mortgage and maintenance charges; financing firms will continue in their present bewilderment and the planters concerned will be fighting a losing battle. What is wanted is mutual confidence and the adoption of a policy of development, instead of the present conditions of stagnation and fear. If this is attained, then the future is a bright one for the coffee industry generally; local conditions are excellent but only in a few cases has the cultivator allowed the coffee tree to exploit them, so many of our coffee trees are now unable to do so, they are inefficient and must be replaced.

44. *Native Coffee.*—The distribution of native Arabica coffee was described in the last annual report, the bulk is and always will be produced on Kilimanjaro where there are about 12,500 growers owning some 4,500,000 trees. Mr. Harvey, District Agricultural Officer, reports as follows:—

"(i) Following the small crop in 1931-32 the coffee was in a condition to bear heavily. The original estimate for the 1932-33 season was 1,000 tons. This, however, is likely to be exceeded by 150 tons in spite of the fact that the coffee in certain of the higher areas failed to crop (bearing here seems to be triennial rather than biennial), and that at lower and medium elevations a proportion of the crop failed to ripen and turned to 'buni'.

"(ii) New plantings were considerable. No figures will be available until the 1933 count is made, but it is estimated at a 10-per-cent. increase. It may be ascribed to the greater fall in prices of other crops, and the reduced demand for plantation and other labour.

"(iii) The most important development during the year has been the change in policy with regard to the application of the Plant Pest and Disease (Coffee) Regulations. Previously nearly the whole time of the staff was given to inspection and the enforcement of certain cultural measures, principally for the eradication of couch grass, which has a very weakening effect on coffee. The policy was based on the assumption that the incidence of pests and disease was the controlling factor in coffee production. During the last year, as the result of work put forward in departmental Pamphlets Nos. 7 and 8 and of observations on native coffee, it has become evident that this policy was purely negative in results, and that the mediocre condition of most of the coffee is due primarily to faulty methods of cultivation. The coffee has been brought to a condition whereby its cropping capacity is limited, while its resistance to disease and probably certain pests is lowered under the strain of even a normal crop. This condition is attributable to a number of factors:—

(a) The use of unsuitable planting material.
(b) Bad planting, particularly deep planting.
(c) Too deep and too frequent cultivation, resulting in the permanent crippling of the surface root system. This is associated with couch grass infestation, often from the time of planting.
(d) Soil erosion and impoverishment.
(e) Too heavy and too frequent pruning.
(f) Contributory causes: irrigation, lack of shade, bad capping.

"(iv) The only cure for this condition is replanting. The new policy aims at the control of new plantings, with the gradual elimination of the unproductive coffee which is a burden to the owner, expensive to the Kilimanjaro Native Co-operative Union in anti-pest measures and also a waste of our time in inspections.

"(v) Simple rules have been enacted by the Native Authorities which give the District Agricultural Officer legal control over new plantings. Under the rules, planting on very steep slopes, on unsuitable soils and in unfavourable situations will be prohibited, and where the site is approved insistence will be made on the terracing or contour-trenching and hedging of other sloping land prior to planting — on the thorough eradication of couch grass before planting — on the use of approved seedlings — on planting at the correct level — on the provision of suitable shade. The aim is to avoid past cultural mistakes and to ensure that every future native grower will be left in possession of coffee which should bear fair average crops each year, and will not be so subject to such pests and diseases as Hemileia and Thrips. No relaxation is being made with the control of pests and diseases, and the Kilimanjaro Native Co-operative Union, Limited, is now far better equipped than ever the old association was to deal in quick time with thrips outbreaks, and to participate fully in the block-spraying measures which are taken by native and non-native alike against antestia.

"(vi) Communal nurseries have been established and planted with Kent's Arabica seed, from which 250,000 seedlings will be available in 1933. The Chagga Native Treasury voted £59 17s. for the nurseries, which are indirectly controlled by the department through the societies. The nurseries will be continued from year to year, funds being derived from a small charge (one cent each) for the seedlings. As it is not known whether the nurseries will meet the demand for planting material, it is proposed to allow planting from well-tended private nurseries also during the coming season. Over 500 overgrown or badly planted private nurseries have been uprooted.

"(vii) Recommendations for cultural treatment (based on departmental Pamphlets Nos. 7 and 8) have been demonstrated to and discussed with instructors and the Kilimanjaro Native Co-operative Union, Limited, employees at monthly meetings, and to cultivators individually and at barazas. They have also been put forward in the form of a small Swahili leaflet, distributed to cultivators, schools, etc., and in *Uremi*, a paper issued monthly by the Kilimanjaro Native Co-operative Union, Limited. The new methods advocated are, however, sometimes in contradiction to previous teaching (e.g. as regards shade at the higher elevations, cultivation and pruning), and it is not likely that a change of method will become general until the progress of new plantings, and of the coffee on the demonstration plots particularly, proves the necessity for such a change. Display boards, and mounted roots and seedlings have been made use of, also a diorama illustrating measures against soil-erosion, irrigation, etc.

"(viii) Some improvement in quality can be claimed mainly through better drying, principally as the result of strict inspection at the godown of the Kilimanjaro Native Co-operative Union, Limited, and a reduction of antestia damaged beans. Nearly all pulperies were visited, pulpers adjusted where necessary, and instruction given; but buyers continue to complain of over- and under-fermentation, which is unavoidable in the preparation of numerous small lots. The scheme for co-operative pulperies has not passed the stage of discussion, but the reorganization of the association into societies is a step in the right direction. The preparation of compost from coffee pulp has been encouraged and over a thousand compost pits are in use."

45. It is desired to record appreciation of the manner in which the Kilimanjaro Native Planters' Association has been reorganized and formed

into the Kilimanjaro Native Co-operative Union, Limited, by Mr. A. L. B. Bennett, Manager of the Association. The criticisms which were made of the association in the last annual report, no longer hold: their present methods of marketing, and their increased equipment and stock of chemicals, together with better efficiency of the native staff and the closer co-operation which exists with the departmental staff, leave a sense of security which has not been the case before. The team work which now exists between the society, the native authorities and this department is a good augury for future all round improvement in culture, pest control, preparation, yields and quality of native coffee.

46. Similar rules to those enacted by the Kilimanjaro Native Authorities, have been in force in the Western Usambaras for the past six months; they will put a brake on hasty plantings on ill-prepared and unsuitable land, yet the individual and the coffee industry will both benefit in the end.

47. *Cultural.*—A much greater interest than ever before has been displayed during the year by planters in the cultural side of coffee production. The detailed observations on the coffee plant, especially as regards the periods of growth and of reduced activity or rest of its component parts, which were begun two years ago, have been continued by every officer working with coffee in this circle. In the last annual report it was stated that: "A pamphlet on these matters is being prepared, not because it is considered that we have reached infallible conclusions, an experimental station is necessary to provide indisputable data, but in the hope that it will lead planters and others on to new lines of thought, trial or investigation." The paper was written and published as departmental Pamphlet No. 7, that some such paper was required is shown by the wide publicity it received both locally and in other countries; it has been translated by planters themselves into Greek and German, and was followed by departmental Pamphlet No. 8, with the aim of demonstrating the ideas contained in the first paper. Both in the pamphlets and at addresses to meetings of coffee planters (including the Coffee Days at Nairobi held by the Kenya Department of Agriculture), it has been widely stressed that while the ideas given in the pamphlets have been based on observations on many thousands of coffee trees under very varied conditions, they must be submitted to a very strict examination by controlled field experimentation and investigation in the laboratory before they can be accepted with certitude, and until this is done they must largely remain an hypothesis. This warning applies only to the theoretical deductions; no practical advice or recommendations for a revision of ideas regarding soil management and treatment of the coffee tree have been given without first being satisfied from every view-point that they are sound, economical and practicable and that more profitable and consistent yields will follow their adoption.

48. The main cultural errors of the past which, it is considered have reduced so many estates to the uneconomic level of biennial bearing are:—

(i) Deep-planting, often caused by planting in pits before the soil has thoroughly consolidated.

(ii) Cutting the mature lateral roots which carry the surface feeding rootlets, by cultivating deeply with hoe, ploughs and disc-harrows. (If only one or two roots are severed on healthy trees they will probably regenerate, but usually in the plantation in deep cultural operations the majority of the roots are cut, and these, if of a mature corky nature, show

no appreciable regrowth in length and so much of the plant food in the soil is placed beyond the feeding range of the tree.)

(iii) Omission to clean the land thoroughly of weeds before the coffee is planted.

(iv) Omission to put in anti-erosion measures at any time. (They are best done before planting, and planting should be on the contour.)

(v) Excessive and unnecessary irrigation especially on the saucer-system.

(vi) Drastic pruning often at the wrong time; in stressing the role of nitrogen, reference is made in both pamphlets to a nitrate deficiency restricting the formation of carbohydrates, a plentiful supply of these being essential to the growth of all parts of the tree, including the roots, and to the production of crop. Drastic pruning especially at the wrong time can restrict or even prevent cropping. Where pruning is necessary this should be done but once a year, and that after flowering at the end of a period of shoot growth; but the need for pruning can be avoided by judicious handling at the beginning of a period of shoot growth.

49. An examination of the root systems of many thousands of trees, leaves no doubt of the essential need for the coffee tree thoroughly to exploit a fertile surface soil. The development of that portion of the root system occurring in the subsoil appears to be in an inverse ratio to the amount and distribution of the rainfall or in the same ratio as the length of the dry seasons; other local and soil factors also affect the development of root systems.

50. The planter has been avid for information, and there are those who doubted at first the basic principles and recommendations of the two pamphlets on coffee culture who are now firm adherents of the practical advice that has been given. Generally, greater care has been exercised to avoid deep cultivation, about twenty dozen vertical forks have been purchased by planters with gratifying results. Irrigation is not so commonly practised, and where it occurs the "sahani" or saucer system is being discarded for a central furrow with silt-pits. Greater care is taken in planting and altogether the coffee tree is given a better chance to behave in the manner which nature intended: there is more moderation in all cultural matters. This progress is bound to have good effect and will help better cropping next year (normally an off-year).

51. A great deal of interest is also now displayed in cover crops, so much so that one enterprising planter is undertaking the commercial production of seed of those cover crops which have proved successful in trials on Kilimanjaro; and he is finding it difficult to meet all the orders which he has received. Cover crops should not be turned under in mature coffee, for, although the soil will be enriched, so much damage is done to the coffee roots that the tree will be worse off than before; the leaf-fall which occurs with permanent covers and the nodulations of the roots give an appreciable increase to the soil of both humus and nitrogen. Cover crops have not been in favour in the past owing to the fact that they have not been studied in relation to the crop between which they are to grow, especially as regards root competition. Under existing plantation conditions it is evident that Arabica coffee is mainly a surface feeder, those cover crops recommended (*Dolichos hosei*, *Indigofera endecaphyla*, *Centrosema plumierii*, and *Pueraria phaseloides*) are all in the main deep rooting and apparently deep feeding, they are also all nodulated and so nitrogen fixing. On loam soils, vertical forking is essential to give a maximum soil-aeration without root disturbance, while on deep friable sandy soils Arabica coffee does best if these are compacted.

52. Manurial trials on estates have been disappointing and little or no difference in the results with various treatments can be seen; this is due to several factors on the different estates: on one the humus content is very low, on another the trees are deeply and badly planted and so on. A series of experiments, including artificial shade, and gypsum treatment for alkali are in progress at Arusha. Measurements are being continued to determine the periods and amount of length-growth in shoots, and of root growth. Arrangements have been made with Amani for the microscopical investigation of the laying-down of flower buds to determine its exact period; when this is known it is possible that manuring and pruning can be so managed as to control cropping to some extent.

53. Mr. G. Milne, Soil Chemist, Amani, his assistant Mr. W. E. Calton, and Mr. D. Sturdy, District Agricultural Officer, Arusha, collaborated in a survey and examination of the waters flowing from Mt. Meru; they conclude from their investigations that these are of poor quality for irrigation purposes and must be used with caution. A paper on this subject, of which they are the joint authors, will be published early in 1933 in the Journal of the East African Natural History Society.

54. Samples of parchment coffee from plots with different manurial treatment have been submitted to brokers to determine whether certain manures have any effect on the liquoring qualities; these tests will be continued for a long period of years.

55. Investigation was made on the merits of fermented and unfermented coffee, with the result, which evidently cannot be regarded as significant, that according to brokers' reports there is no difference in liquoring qualities between coffee that had been fermented and coffee produced without the process of fermentation. More exact tests under strict control have been made with this season's crop, but no reports of the brokers have yet been received.

56. Several applications have been made for permission to erect a coffee cleaning and curing works. It is considered that such a local works would be of great value to the coffee industry, not only in giving a saving of one-fifth of the rail and freight charges, but also in putting a better product on the market by the early removal of "stinkers" and other defective beans; the lower grades could also be marketed to better advantage. That there is a decided benefit in local cleaning is seen by the increasing patronage of the Kenya coffee cleaning works by Tanganyika planters.

57. *Coffee Advisory Board.*—The Coffee Advisory Board was reconstituted during the year, unofficial members now being nominated by the planters' associations of the areas they represent. The Board now consists of four official members, including the Director, Amani, and seven unofficial members, including the Manager of the Kilimanjaro Native Co-operative Union, Limited.

58. *Tea.*—The Eastern Usambaras of high rainfall have been considered as eminently suitable for tea, and Dr. Mann viewed the district as a suitable one for the production of medium grade tea. The area involved is immense and there are vast existing estates, at present undeveloped, where tea could be grown. One estate has about 800 acres under this crop, and the leaf from a near-by estate is purchased and manufactured by the larger concern. In 1932, 45,000lbs. of tea were produced, a part was sold locally, and consignments exported to London realized a price of one shilling per pound. The production fell considerably below the estimate made a year ago. It is evident that if

anti-erosion measures are not put in as advised, the losses both of soil and of planting effort are considerable.

59. *Cacao.*—Criollo cacao thrives in several sheltered valleys of the Eastern Usambaras. One estate only is producing, and the quality is so high that buyers have often stated their desire to handle much greater quantities. Trial plots are being planted to determine the limits at which cacao will thrive in the Eastern Usambaras. Twenty hundredweights were exported during the year and realized £70 to £75 per ton.

60. *Kapok.*—Kapok is mainly confined to the Korogwe District, there is a good market for this product, and prices have been about twenty per cent. higher than last year. In 1932, 68 tons were exported at a value of £4,790; in 1931 the exports were 66 tons valued at £3,500. The area under this permanent crop is gradually increasing.

61. *Cinchona.*—*Succirubra*, *officinalis*, and *ledgeriana* species of cinchona grow well in the Eastern Usambaras. One consignment of carefully prepared quinine bark realized the high price of Sh. 1/8½d. per pound in open auction. Quinine can be regarded as a profitable side-line to the estates of the Eastern Usambaras.

62. *Maize.*—The present maize prices (the London price remained fairly constant at Shs. 20/3d. per 480lbs. over the greater part of the year but later fell to Shs. 18/3d.) practically rules out maize as an economic plantation crop. The local price (now Shs. 3/50 to Shs. 4/50 per bag of 220lbs.) is controlled by the Kenya prices, which normally depend on the home price. Much European maize is held up in the hope of a better market, despite this over 1,600 tons of maize (mostly of native production) have been exported, all local needs have been met from local production and large stocks are still on hand everywhere. In 1932 only 170 tons of maize were imported through Moshi and Tanga; in 1930 the imports of maize amounted to 1,710 tons while the exports were negligible.

63. *Copra.*—The exports of copra from Tanga Province, mainly to Zanzibar, over the past four years are as follows:—

	Tons	Value Shs.
1932 ...	1,573 ...	284,029
1931 ...	2,119 ...	409,132
*1930 ...	3,580 ...	1,320,420
1929 ...	3,857 ...	1,713,805

64. The decreasing figures of export are to some small extent due to the increasing use of copra by local soap-works, but much more so to neglect of the plantations which are mostly in the hands of natives, who have inherited them from their fathers but who obviously have no thought for the welfare of the future generation. It has long been evident that drastic action was necessary under the Plant Pest and Disease (Coconut) Regulations, and after two years of propaganda and patient work, the regulations were strictly applied during the current year in an endeavour to secure from further loss the territorial asset represented by its coconut plantations. The District Agricultural Officer, Tanga, made 5,598 inspections and 13,887 inspections were made by

*The figure 5,580 tons given in the annual report for 1931 is an error and should read 3,580 tons. See paragraph 55 of 1931 Report.

the native staff; 3,633 verbal warnings were given, 655 written notices were served and 65 prosecutions made under the regulations. The administrative officers have given valuable co-operation in the campaign which has had satisfactory results in improved upkeep of plantations and removal of diseased and dead trees that act as foci for further infections and losses. In an endeavour to cope with the extensive thefts of coconuts, natives have imposed upon themselves in certain areas restricted periods for harvesting; this should also tend to improve quality, but the methods of preparation of copra are so poor and marketing so tied that little progress can be made.

65. *Cotton.*—The sales of seed-cotton by natives in 1932 were as follows:—

Area	First Quality lbs.	Second Quality lbs.	Third Quality lbs.	Total lbs.	Value Shs.
Handeni ...	869,271	21,910	158,525	1,049,706	70,063·05
Pares ...	669,608	92,688	212,949	975,245	70,095·55
Moshi ...	66,372	2,174	30,457	99,003	7,517·17
Total for 1932-33 season up to 31st Dec., 1932 ...				2,123,954	147,675·77
Carry over from the 1931-32 season				25,663	1,100
Grand total for 1932				2,149,617	148,775·77

66. The Handeni cotton return includes approximately 1½ tons produced in the Bagamoyo District, sold in Handeni, while it is estimated that approximately 25 tons of Handeni cotton was marketed in the Morogoro District.

67. It is estimated that a further 15,000lbs. of seed-cotton in the Pares and Moshi will be marketed in January, 1933. In 1931 the total production of native-grown seed-cotton was 221,469lbs. which was purchased for Shs. 9,766/-, that is an average price of 4 to 5 cents per pound of seed-cotton as compared to an average price of practically seven cents per pound in the current season. Given favourable weather conditions, a further large increase is anticipated next year, mainly through the satisfaction which has been given to the native by good prices and facilities for marketing his crop, and more especially in the Pares District.

68. Non-native grown seed-cotton to the extent of 18 tons was produced in the Lushoto and Pares Districts and 31 tons in the Moshi and Arusha Districts.

69. The output of cotton lint by the ginneries of Mzundu and Kwanegero in the Tanga Province and of Himu and Moshi in the Northern Province is as follows:—

Province	1930 lbs.	1931 lbs.	1932 lbs.
Tanga ...	68,574	6,777	83,936
Northern ...	52,650	13,615	185,964
Totals ...	121,224	20,392	269,900

70. The 1932 figures include a carry-over of 157 standard bales (400lbs.) from the 1931-32 crop, and it is estimated that the carry-over of the 1932-33 crop will be 1,095 bales. The ginneries operating in the Handeni District are not satisfactory, and the owners have submitted proposals for the erection of an up-to-date and properly equipped ginnery to be sited at Sindeni in the Handeni District.

71. *Essential Oils.*—(i) Reports of the Imperial Institute and brokers on peppermint oil produced in the Northern Province on a small experimental scale have shown that the imported plants are unsuitable for the production of high grade oil. A further strain is under trial at Lushoto, together with other essential oil plants such as *Rosmarinus pyramidalis*, *Melaleuca leucadendron*, *Pelargonium radula-roseum* and *Pogostemon patchouli*.

(ii) The presence of large plantations of Seville orange trees put in by rubber planters before the war, give to some sisal planters a source of revenue in the preparation of equellor-oil from the fruit of the orange, and the distillation of petit-grain oil from the leaves. The Director, East African Agricultural Research Institute, provided equellors for trial; 16½ fluid ounces of equellor oil is produced by 1,000 oranges (best results are obtained from the oranges when they are just turning yellow, than from over-ripe or under-ripe ones). A still for experimental purposes of twenty-gallon capacity was purchased, and with this petit-grain oil is being distilled in bulk quantities to test the market. Two years ago locally produced petit-grain oil was valued at Shs. 8 75 per pound in comparison with Shs. 6 50 for the oil from the main producing country of Paraguay, since then the price of the latter has fallen to Shs. 4 75. It is difficult to get perfumery makers on to a new line, owing to the fear of altering their preparations; but it is considered that if a good supply could be guaranteed, a market would be forthcoming for the Tanganyika product.

(iii) Enquiries were received from a New Zealand firm regarding the possibilities of establishing an essential-oil factory in a citrus growing area; it was possible to give a favourable reply regarding the Tanga District.

72. *Other Products:* (i) *Vegetables, etc.*—The Western Usambaras supplies the Tanga market with fresh vegetables, but no extension of sales can be expected until there is better preparation for market, when this is done the shipping lines should offer a ready market. The export of onions from Moshi and Arusha was increased from 158 tons in 1931 to 341 tons in 1932, while 15 tons went to Tanga, where the imports fell from 118 tons in 1931 to 80 tons in 1932. The native production of onions on Kilimanjaro for the year is estimated at over 400 tons at a total value of £2,400. Trial of Egyptian, Indian and Bermuda onions are being made. The production of potatoes remains low and does not meet local requirements; imported seed of Great Scot and Kerr's Pink has been widely distributed throughout the Western Usambaras.

(ii) *Fruit.*—Good stone fruit (Japanese plums and peaches) are grown in the Western Usambaras but not in sufficient quantities to supply all local requirements. Grapes are grown for wine near Lushoto. Citrus is widely grown by natives in the Muheza area of the Tanga District, exports being mainly to Nairobi and Mombasa during the main season of April to August; sample crates of selected fruit of the second crop were forwarded to the Empire Marketing Board to test the home market, the bare months there being August to October. The cost of 112 fruits to fill one crate is 25 cents, the freight to England in cold storage is Shs. 4 60 per crate. Enquiries have been made regarding the Bombay market for pineapples.

(iii) *Dried Bananas.*—A banana drying factory at Handeni is turning out good quality "banana-figs" which find a ready sale to the chocolate makers in England. Another factory near Korogwe is concentrating on banana flour and dried banana chips.

(iv) *Tobacco.*—Both Virginia and Turkish tobacco are grown to a small extent by Europeans in the Mombo and Korogwe areas, the produce has received favourable report by brokers in England. Some native tobacco is also grown.

(v) *Oil Palms.*—These grow well at the lower altitudes of the Eastern Usambaras and a small export of 60 tons of palm oil and 30 tons of palm kernels was made during 1932.

(vi) *Wheat.*—A wheat mill is now in operation at Arusha which should help to supply local requirements. Trials of rust resistant varieties (provided by the Senior Plant Breeder, Njoro, Kenya) for Arusha, and bearded types for Kilimanjaro are in progress.

(vii) *Rice.*—Formerly considerable amounts of rice were imported, these fell from 1,500 tons in 1930 to 650 tons in 1931, and again to 230 tons in 1932; 350 tons of rice produced in the Pares were placed on the local market in 1932. Demonstration plots of irrigated rice have been laid out in the Pares and it is expected to obtain an exportable surplus of 750 tons of rice from that district with the crop planted towards the end of the current year. Varieties of the high-priced Carolina types are under trial.

(viii) *Butter Beans.*—The production of Madagascar butter beans has been increased by coffee planters in the Northern Province, enquiries have been received from England regarding supplies of this crop, and it is expected that a good market will be forthcoming for restricted amounts. Present prices of £15 to £18 c.i.f. are good.

(ix) *Beeswax.*—The possibilities for the production of beeswax especially in the Pares and Moshi District are great. A trained instructor was supplied by the Assistant Entomologist, he has done excellent work and a good export of beeswax should be the outcome next year.

(x) *Telfairia Nuts* (Kweme).—Two planters are actively engaged in marketing the indigenous Telfairia nut. Reports from England are not encouraging: there are difficulties of shelling and marketing the nut which contains 62 per cent. of oil, but the two planters concerned are optimistic of overcoming them.

(xi) *Cassava.*—Mainly as a safeguard against famine through possible locust damage to crops, there has been a large increase in the area under cassava (muhogo), the sales of dried cassava have been nearly trebled (in the Lushoto, Tanga and Pare Districts 642 tons were railed as compared to the average of 66 tons in previous years). Cassava starch is a profitable side-line to the native.

(xii) *Spices, etc.*—Cardamons thrive in the Eastern Usambaras, the wild cardamon is collected in small amounts for sale locally, but it is of very poor quality, and plants from imported seed of the Mysore and Malabar types have been introduced. Two tons of black pepper were produced by one estate and sold locally; on this estate, nutmegs and vanilla also do well. One ton of the small red chillies was sold at a good profit from a Pare estate. Large chillies are produced in the Northern Province for local use.

(xiii) No appreciable quantity of groundnuts are produced in either the Tanga or Northern Provinces; there are many suitable areas and the native authority has purchased one ton of seed for multiplication and distribution to the higher slopes of the Pare Mountains unsuited to cotton.

73. *Experimental Station.*—The proposals for a coffee experimental station for the Northern Province received the approval of the Secretary of

State, and funds have been provided from the Colonial Development Fund. About three hundred acres of land on the site previously selected, and which has received general approval, was purchased, the land for the buildings has been cleared and the lay-out of these has been decided.

74. The matter of an experimental station for sisal is still undecided. Negotiations were made for the provision of a suitable site, these are still in progress.

75. It is very obvious both throughout this circle and in the Iringa Province, that extensive planting development, before experimentation has been made to determine the methods which should be followed, has been expensive to both the individuals concerned and the Territory as well.

76. *Agricultural Sub-stations.*—(i) A citrus demonstration plot, financed departmentally, exists at Muhesa to demonstrate methods of planting citrus trees on terraces, for the trial of new and improved varieties and for the supply of planting material and bud-wood to obtain, as far as possible, the production of standardized good quality fruit for the local markets and, it is hoped, for export.

(ii) The sub-stations maintained by native authorities as follows, are mainly of the nature of seed-farms: At Lushoto there are five acres mainly of terraced land from which eight tons of Potchefstroom Pearl maize, six tons of Kerr's Pink and two tons of Great Scot potatoes (from Scottish seed) have been distributed. It is being developed as a model mixed farm: coffee, fruit trees of all descriptions, edible canna, potatoes, maize, essential oil plants are all now grown, and it is hoped that later a model dairy will be built. The ensemble should show what a small man can do with intensive farming on a small scale. The prison farm was also taken over; nine acres of this are already terraced and the remaining thirty-one acres will be completed early next year.

(iii) At Pangani and Handeni there are small seed-farms for the multiplication of White Cango maize, and cassava cuttings.

77. *Pests and Diseases.*—Mr. A. H. Ritchie, the Entomologist, was stationed at Moshi during the year, and his report will deal with the pest side. Similarly Dr. Wallace, the Mycologist, who paid a visit to the Northern and Tanga Provinces in July and August will report on the diseases affecting production.

78. In the annual report for the year 1931, the necessity was described, owing to the poor crop and the short-sighted policy of making cash advances only on actual crop with no thought for the future, of applying the Plant Pest and Disease (Coffee) Regulations in more vigorous fashion than usual. With a few exceptions that need was not seen with the present season's good crops, but it is bound to arise again next year, when low yields must be expected. Block-spraying for Antestia was continued.

79. The campaign followed for better sanitation of coconut plantations has been described in paragraph 70 above.

80. *Locusts.*—Flying swarms of the Migratory locusts invaded the whole of the Northern and Tanga Provinces in the latter part of 1931, and there was soon a wide infestation of hopper bands. The policy was followed of attacking all accessible hopper bands after full protection had been given to standing crops. A campaign was waged from Tanga to Babati, in which twenty-two officers of the Administrative, Veterinary, Forestry, Tsetse Research Departments, and the King's African Rifles and this department all participated;

this was only possible through their work either being sacrificed for the time being, or their brother officers taking the full burden. It is due to their unfailing and strenuous efforts that practically no damage to crops was caused by hoppers, and that escapes from flying swarms were negligible. A minimum of ten thousand natives daily were engaged for a period of five to six weeks round Kilimanjaro and the Pares; 9,500 bags of locally made poison-bait were used effectively and six sprayer pumps, accounting for six tons of sodium arsenite. With the wide scope of the operations seen by the public we were reproached for spending the imaginary sum of several hundreds of pounds per day against locusts in these hard times; actually the local expenditure amounted to Shs. 22,102/23 for this campaign while Shs. 9,387/25 were expended in a second outbreak which occurred in May and June. In co-operation with Kenya this department extended its anti-locust activities into Kenya as far as Maktau, and north-west of Kilimanjaro to a depth of several miles on a front of fifty to sixty miles, here the locust hopper bands were extremely large and dense. Some flying swarms again appeared from the north in the latter part of the year; the inaccessible Serengeti Plains have remained a source of infection.

Conclusion.

81. The year has been marked by a whole-hearted spirit of co-operation between individual officers and departments, but the progress which has undoubtedly been made would not have been possible without the support that has been given by the planters themselves, by traders and the commercial community generally, and by the better type of native chief. But, despite the large increase in exports of native produce, if these are compared with potential production of the existing population, instead of past figures of exports, then there is less satisfaction in the present and a desire for even greater effort in the future. Not more than twenty days of easy work are required to produce an acre of cotton which has brought to many growers this season a return of Shs. 60/- to Shs. 70/-, yet taking the number of those who took cotton-seed for this season, it is but half of the able-bodied males who could grow cotton in areas which are not sources of estate labour, the average return to them is a paltry Shs. 14/- per acre. Then we have only to turn to the vast fertile expanses which are untouched to complete the picture.

A. J. Wakefield,
Senior Agricultural Officer,
i/c North-Eastern Circle.

ANNEXURE II.

NORTH-WESTERN CIRCLE.

Lake and Western Provinces.

General.

The agricultural progress made during the past year can be reviewed with no little pleasure. I pointed out in my last annual report that the response of the natives to the increased production campaign had been marvellous and although export figures did not come up to expectations this was due to factors generally outside the control of the natives. There is still room for improvement but officials and non-officials who know the areas dealt with in this review are unanimous in the opinion that a greater acreage was put under cultivation than ever before. The causes of crop failure and low yields were many and will be dealt with under the various heads.

2. Owing to the fact that the total area of high productive land, enjoying a well-distributed rainfall, is small and that natives have concentrated in these areas there is a definite shortage of land in some localities. One cannot expect high yields if crops are cultivated year after year on the same land and no attempt made to rotate crops or manure the land. The remedy would appear simple but unfortunately it is not so simple as it would appear. Each area has evolved a particular type of native cultivator and the economic crops suitable to it have been encouraged. The popularity of these crops has largely depended on the cash return a native has received and how the crop has suited his agricultural customs. One can readily conceive that very little attention was paid on the part of the native to whether the crops he selected to grow were suitable for rotation or not. He overcame this difficulty by rotating his land instead of his crops. When prices were high low yields were of little moment as the cash return he received was ample to meet his requirements. Such low-producing land is no longer profitable to cultivate. During the past year practically every square yard of the better soils in the inhabited areas was cultivated but there was by no means sufficient to satisfy the requirements and large acreages of poor unfertile soils again came under cultivation. The resultant poor yields returned very little to the native for his labour and added comparatively little to the export figures.

3. There are still large areas of uninhabited land admirably suited for agricultural development but the building up of settlements in these areas is a slow process and affords no immediate solution of the problem. Each agricultural community has its staff of witch doctors, rain makers and medicine men who are all-important in the eyes of the native cultivator and each operation in agriculture has its special ritual which is religiously followed if success is to attend their efforts. Effective native settlement of a new area can only happen if the staff essential to agricultural practices moves with the people. One finds that natives who, through contact with Europeans, particularly planters, have managed to overcome superstition and disregard all tribal agricultural customs are the pioneer settlers of new areas and demonstrators of improved cultural methods and of more progressive habits in their own areas.

4. Our aims during the past year have been to increase the yields of crops per acre ; to improve marketing by concentrating the produce at vantage points and by reducing or eliminating barter ; to introduce rotation of crops and the use of green manures in order to maintain soil fertility in the congested areas ; to improve the quality of produce by the introduction of grading rules in the case of coffee, the establishment of cleaning centres for beeswax, the rogueing of rice fields and the selection of the best types of all crops for seed and experimental purposes.

5. With the above aims in view our work has been organized. The traders and merchants interested in the purchase and sale of native produce have co-operated and materially assisted us in our work, but the difference in prices paid for different qualities still leaves much to be desired.

Experimental Stations and Native Authority Farms.

6. The crops grown are common to the tropics and sub-tropics, and a considerable amount of research and investigational work has been carried out on them in other countries. The results of such work have been carefully studied and, as far as possible, applied to suit local conditions and market requirements. A certain degree of success has been obtained but it is considered that the stage has been reached when local research and experimental work on the established crops are imperative if we wish to maintain or increase our prosperity. Valuable work is being done in the North-Eastern Circle in connection with coffee and the results of such work will be applicable to Bukoba and Bugufi, but our positive knowledge of cotton, groundnuts and rice, and the effect of rotations and green manures are limited. Agricultural officers must be given opportunities of experimenting and trying out methods which have been adopted in other countries before they can, with confidence and safety, advise the application of them to native agriculture in their own areas. Unfortunately we have no European farmers to set the example to the natives so it is left to the department to do the demonstration work as well as the experimental work.

7. In 1927 an experiment station was opened at Ibadakuli, Shinyanga, to serve the then Tabora and Mwanza Provinces. It soon became apparent that such an experiment station could only serve the vast lake shore producing areas of the Mwanza Province to a very limited degree. Experimental work on rice could not be undertaken and the variety of cotton suitable for one area proved unsuitable for the other so that the lake shore has been severely handicapped in not having a station to deal with its own problems. The Nyanza Federation farm at Ukiruguru, Mwanza, and the Shanwa and Mwasitta farms in Maswa, although essentially demonstration and seed raising stations, provided a means for the planting of observation plots. The results could not be treated statistically, but they at least gave us a tendency on which to build up our field work. Similarly in the Musoma District a considerable amount of observation work has been done on rice. Small plots were also set aside at these farms for the trial of any introduced type of crop considered of value to the district.

8. The original purpose of Native Authority farms was two-fold. They were intended to demonstrate better methods of agriculture and to propagate seed of approved varieties for distribution to the natives. Unfortunately they sprang up in all areas and it became impossible for agricultural officers to supervise them efficiently with the result that many of them became a positive

eyesore to the district and uneconomic. Nevertheless, the objects which these farms were intended to achieve are necessary to development. Seed raising stations are necessary for the propagation of seed which, after it has passed the experimental stage, must be available in reasonable quantities before being distributed to the natives. Furthermore, under field conditions, and bearing in mind we are dealing with a primitive native people, it is impossible to keep seed pure and prevent it from deteriorating rapidly. To maintain purity and quality, continuous supplies of selected seed must be raised at these stations and whatever steps are taken to effect economies in the expenditure of Native Treasury moneys essential seed-raising stations such as Lubaga and Ukiruguru should be maintained. It has been found more effective and economical to reduce the number of large demonstration farms and to get the African instructors and keen natives to lay down small demonstration plots of one or two acres in each area.

9. *Lubaga.*—In 1931 the experimental work was transferred from Ibadakuli to Lubaga. The main activity has been in connection with the U/4/4/2 cotton and comparative trials of other varieties. Work has also been carried out with groundnuts, maize, various legumes and sorghums.

10. The details of the experiments and the results are given in a separate report. In conjunction with the experiment station the Native Authorities have run a seed-raising station under the supervision of the department and it is interesting to note that for the two years we have been able to return a profit of over £350. A further outstanding fact is that in 1931 the total production of cotton on the station exceeded that of the district by twenty-two tons and this year the total production of the district only exceeded that of the station by thirty tons.

11. *Ukiruguru.*—A section of the Nyanza Federation farm amounting to thirty-five acres has been acquired for experimental purposes. The sorghum, cotton and groundnut selections made in the field during the past season will be planted out at Ukiruguru with a view to further selection. Particular attention will be paid to rotation of crops and the results of green manures applied to local conditions. In congested areas, such as Ukerewe Island, the crops grown are millets, cotton and rice. These crops alone do not lend themselves to rotation. The introduction of groundnuts would help but, as the land is limited, it does not appear sound to introduce a third cash crop which might proportionately reduce the cultivation of the other two, and the introduction of a green manure crop would be the best method. There is an indigenous crotolaria but the behaviour of sunn hemp *Crotalaria juncea*, which has been tried out during the year, has proved sufficiently satisfactory to encourage us to carry out field trials. Plots of sunn hemp have been laid down which will be hoed in at the beginning of January and millets planted in February.

12. *Mwanza.*—The difficulty of getting suitable land for our rice experiments near enough to Mwanza to ensure economic supervision compelled us to select about two acres of land on the lake shore and within the township. This land is ideal for our purpose but the township regulations with regard to mosquitoes make it difficult to irrigate the land sufficiently and control mosquitoes to the satisfaction of the Medical Officer of Health.

13. Apart from the work being done locally with sorghums and millets, field selections of all the local types have been sent to Morogoro experiment station for further trial and selection.

14. During the year the Mantare and Ngudu farms in the Bukwimba District and the Uha Federation farm, Kasulu, were closed and the programme of work at Ibadakuli, Shinyanga, and Ndoma, Nzega, was considerably reduced. The Nyanza Federation farm was successfully maintained and, in spite of the failure of the cotton crop, out of Shs. 2,600/- expended, Shs. 1,140/- were returned as revenue, and seed and stock feed to the value of Shs. 725/- were distributed to natives.

15. The demonstration farms at Shanwa and Mwasitta also served a useful purpose. A dairy herd is maintained at Shanwa and the farm paid particular attention to the production of fodder and ensilage crops. Inter-planting of cotton trials, groundnut selections and mass selection of heads of the very promising introduced awned bulrush millet were undertaken.

Ploughing.

16. Chiefs and headmen anxious to give their people a lead in the increased production campaign have brought their ploughs into commission again. Ten simple wooden ploughs, with iron points, have been made locally and presented by the department to the Maswa District in order to encourage the use of this simple implement. Ox-drawn ploughs are used on all the native authority farms to cultivate the land.

Cotton Seed Distribution.

17. Early in the year arrangements were made to reserve seed from the first picked cotton. This ensured, as far as possible, that the best seed would be made available for distribution. The Director of Agriculture met the ginners in September and arrangements were made to return half the proceeds of the cotton cess to purchase and distribute the seed. Distribution began in November when eight hundred and sixty-four tons were transported to the various centres in the Mwanza, Kwimba, Maswa and Musoma Districts and twenty-five tons of U/4/4/2 to the Shinyanga District. In addition, eighty tons are held in reserve and there is every indication that this will be planted up.

COTTON-SEED DISTRIBUTION (in tons).

	1930/31	1931/32	1932/33
Lake Province (excluding Shinyanga) ...	597	752	864
Shinyanga	102	40*	35†

* 25 tons U/4/4/2.
† 25 tons U/4/4/2.

18. Increased demand for cotton seed is recorded in—

(a) Karumo area of Uzinza;
(b) Ukerewe Island and Mainland;
(c) Maswa District; and
(d) Musoma District.

The failure of the crop last year and the poor yield in previous years have weakened the demand for seed in the Bukwimba District but while the acreage under cotton is declining that under groundnuts and rice is steadily increasing.

Marketing Improvement and Extension.

19. In a native area where the bulk of the native producers are illiterate it is considered not only necessary but the duty of those responsible for

encouraging production to ensure that the native can dispose of his produce on fair and equitable terms. If success has to attend our efforts in the field the natives must also realize the relative value of the various crops. The simplest way to achieve both objects is to give all produce a definite value in terms of cash. The marketing of native produce has received the serious attention of Government during the past season and steps were taken under the Market Ordinance and the Trades Licensing Ordinance to control marketing and make cash payments compulsory for certain crops, particularly groundnuts, rice and gum arabic. Any control exercised was designed to interfere as little as possible with the existing trade organization and, although the arrangements made were by no means perfect, they were a vast improvement on previous years.

20. *Cotton.*—There was no change in the marketing arrangements for this crop except that an additional buying post was opened at Kayenze. No ginning was done at Runere, Malampaka, Nyanguge and Lohumbo ginneries. Tenders were invited for the Shinyanga crop of U/4/4 2 cotton and Messrs. Bhagwanji Sunderji, of Bukumbi Ginnery, were successful.

21. The use of motor lorries and dhows to provide free transport for natives with cotton to and from ginneries, markets and buying posts increased considerably. Each firm employs its own transport rider for the season. Until ginning is in full swing there is very little work for them to do and for every pound of cotton they bring into the ginneries or markets they receive one cent. Natives have come to rely on this and hundreds with their cotton collect at various points on the main roads and avail themselves of the free ride. The lorries and dhows operate mainly at points midway between markets and ginneries. The ginners maintain that this pays them as more cotton is brought direct to their ginneries and, if in the normal course of events, the crop went to markets and buying centres, they still have the transport costs to pay on it. In addition, they have the overhead charges and risks of maintaining buyers and stores in markets and some prefer to rely on getting their share of the cotton by the use of lorries.

22. The following facilities existed in the Lake Province :—

Markets		Ginneries		Ginnery Buying Posts
16	...	12	...	14

In the Mwanza area prices opened at 7 to 10 cents per pound for first grade and closed at 10 to 12 cents. Fancy prices up to 20 cents were occasionally paid for one day to encourage sellers.

23. Maswa District opened at 6 cents per pound first grade with few sellers and the crop ultimately changed hands at 10 cents per pound.

24. Shinyanga District opened at 6 cents per pound and rose to 10 cents, the bulk of the crop changing hands at an average of 8 cents.

25. *Groundnuts.*—The marketing of groundnuts was controlled and cash payments were compulsory in the main producing areas. In the Mwanza, Maswa and Kwimba Districts native authority markets were established in the trading settlements and the purchase of the crop was restricted to these markets. A circular or rectangular area was fenced off and stalls erected. Stall holders were charged 50 cents per day or Shs. 10/- per mensem for each stall. A market master and native clerk were in charge. Weighing facilities were provided and natives could obtain information of the prices being offered at the various stalls. In the Western Province no markets were established;

the only restriction placed on buying was that cash payments were compulsory. In the Shinyanga District several chiefs evolved a marketing system of their own. They were kept informed of ruling market prices and organized marketing safaris. They went with their people to the trading settlements and advised them of the prices being paid at the various dukas. At settlements near railway stations and ports groundnuts changed hands at an average price of 80 to 90 cents lower than Dar es Salaam or Mombasa. The natives were satisfied with the prices paid and have asked for the same system to be applied to all produce.

26. *Rice.*—No restrictions were placed on the marketing of rice except in the Kigoma Province where cash payments were made compulsory. The marketing facilities were ample but many of the chiefs and natives have asked for controlled markets similar to those for groundnuts. Ruling prices in Mwanza for paddy (in cents per kilo) during the season were :—

	June	July	August	September	October
Maji Maji ...	6	6¼	9	9½	9½
Seni ...	8½	9½	11½	12	12½

27. *Gum Arabic.*—No restrictions were placed on the marketing of this crop except in the Shinyanga District where cash payments were made compulsory.

28. *Coffee.*—The Produce Export (Bukoba Coffee) Rules came into force on 1st April, 1932. The rules prevented the export of coffee not up to a certain standard and made grading compulsory. Coffee was graded as F.A.Q. and undergrade. Certain minor difficulties in the practical application of the rules necessitated amendments being made and these were introduced in June. Inspection before export was still necessary but grading was made optional. The grades were altered to G.A.Q., F.A.Q. and Triage.

29. The Director of Agriculture met representatives of the Bukoba Chamber of Commerce on 27th September and they expressed their entire satisfaction with the application of the rules. An extract from Leslie & Anderson's *Market Review* for the quarter ending 30th September is of interest :

> "*Bukoba's and Uganda's.*—Operations under this season's new government inspection have on the whole worked fairly well, at any rate we have not experienced the troubles existent in previous years with deliveries of coffee obviously wet before being bagged. We have had an active market during August-September at rising prices, chiefly for shipment to the United States and Canada, due no doubt to a scare of a shortage of supplies from Brazil."

In connection with the Bukoba merchants, the District Agricultural Officer reports :—

> "Regulations with merchants have improved very considerably since the introduction of the Grading Rules. The earlier spirit of distrust and suspicion has gradually been replaced by a spirit of goodwill and what amounts to co-operation on the part of many of the traders. They realize now that they were in danger of losing their trade and are more than satisfied with the results of the season. They now realize that this was not an imposition or interference with trade on the part of Government but an effort to safeguard their markets."

30. *Number of bags of 200 pounds:—*

	Inspected and graded. G.A.Q. Bags	F.A.Q. Bags	Triage. Bags	Inspected only. Bags	Total passed for export. Bags
Plantation	263	10,107	1	2,386	12,757
Native	—	55,336	—	4,535	59,871
				TOTAL	72,628

	Rejected.
Plantation	419
Native	5,312
TOTAL	5,731

Ruling prices per frasila (36 pounds) throughout the season were as follows :—

	Arabica Shs.	Robusta Shs.
January	12/75	11/75
February	11/25	10/-
March	8/- to 9/-	No sales.
April	11/75	10/50
May	11/50 to 13/50	10/25 to 12/25
June	10/- to 11/-	9/- to 10/-
July	11/- to 16/-	10/- to 12/50
August	16/-	12/50 to 14/-
September	14/75	13/75
October	14/75	13/75
November	13/75	12/50
December	—	—

31. *Tobacco.*—The Biharamulo crop was purchased by the East African Tobacco Company, Dar es Salaam. The crop was prepared and baled by an African instructor of the department. First and second grades were sent to Dar es Salaam while third grade was made into coils for sale locally. The ruling prices paid at Biharamulo were :—

1st	70 cents per kilo.
2nd	50 ,, ,,
3rd	23 ,, ,,

CROP PRODUCTION.

32. In connection with crop production too much stress cannot be laid on the importance of maintaining an efficient field staff of African instructors in a native area.

33. *Coffee.*—In the Lake Province the cultivation by natives of this crop is confined to Bukoba, Bugufi, and the Kimwani area of Biharamulo and, in the Western Province, to the Kasulu and Kibondo Districts. Trials are also being carried out with Arabica in North Mara, Musoma District, and Ntumgamo, Biharamulo District. The introduction of the coffee rules called for the production and preparation of a standard quality of crop and a considerable amount of field instructional work was required to get the natives to grade their crop up to standard. Damp and wet coffee was the chief difficulty and strenuous efforts were made to ensure that natives erected drying trays

off the ground to dry the crop properly before offering it for sale. So successful was the campaign that the District Agricultural Officer reports: "It is interesting to note that scarcely a single bag of musty coffee has been presented for inspection at the grading establishment."

34. Particular attention has been given to the handling and pruning of the arabica trees and to the general improvement of plantations. Neglected and deserted plantations are still a source of danger and difficulty, but an administrative officer has been seconded for special coffee duty in Bukoba to deal with such matters. During my recent tour I was impressed with the great improvement that had taken place in the past year. Under Mr. Savile's energetic guidance, supported in his efforts by the District Officer, the chiefs and sub-chiefs have at last been awakened to the fact that the prosperity of their areas lies in their valuable coffee crop and the Native Administration is now a staunch supporter of any measures that will improve the coffee industry.

35. During the past year field conditions have improved and the rubbish removed. The coffee has been brought up to a standard quality before export and the co-operation of all parties has been assured. This has paved the way to real constructive and educational work, and, if close touch is maintained with similar work being undertaken in the North-Eastern Circle and applied to suit Bukoba conditions and the spirit of co-operation fostered, prospects appear brighter than ever before.

The export figures for the year are :—

	1931 tons	1932 tons
Arabica	1,738 ...	1,401
Robusta	4,848 ...	5,705

36. Coffee production in the other areas is still in its infancy. The conditions under which it is being grown do not compare favourably with Bukoba but, with careful attention to cultural operations, cover cropping and manuring, there is no reason why a very profitable native industry should not be established in Bugufi.

37. *Cotton.*—Two types of cotton were grown: Uganda upland in all districts excepting Shinyanga; U/4/4/2 throughout the Shinyanga District with the exception of Salawe. An enormous increase in acreage over previous years was recorded, and during the initial stages of growth everything pointed to a record crop. Towards the end of February a conservative estimate of 12,000 bales was tendered but the general opinion was that 20,000 bales would easily be reached. The cotton in the Bukwimba District was subjected to a long period of drought and never recovered. The heavy rains in April were followed by considerable flower shedding and in June a high infestation of insects — jassid and white fly — spread through all the cotton-growing areas causing Leaf Crinkle and doing considerable damage to the plants.

38. The District Agricultural Officer, Shinyanga, reports: "The main crop of U/4/4/2 suffered to the extent of an estimated reduction in yield of at least 50 per cent. but the jassid resisting property of U/4/4/2 undoubtedly averted a more serious loss as it would appear that a non-resisting variety would have been completely wiped out under stress of such a severe infestation."

39. The District Agricultural Officer, Mwanza, reports: "The usual pests of cotton were present, but of greatest danger to the industry is the 'Leaf Crinkle' by whatever it may be caused, jassid or white fly. The latter

was not noticed at the beginning of the season but was undoubtedly present and mistaken for jassid. Both pests were prevalent over the whole area and the resultant effect on the structure of the cotton plant was pitiful. Many natives' plots planted at optimum times produced literally nothing for labour involved. Observations made at Ukiruguru Farm showed an average of 41 per cent. of bolls stained, and 13 per cent. bored by Spiny Boll Worm. Whilst the flower shedding percentage averaged 65 per cent., stained bolls to flowers 14 per cent., bored bolls to flowers 4 per cent. and undamaged bolls to flowers 17 per cent.

"The former were observations on 2,400 plants and the latter on 600 plants. Stained lint was 32 per cent. by weight and yet stainers were not unusually prolific. Boll counts towards the end of the season in July showed from 85 to 98 per cent. of staining demonstrating full well the futility of late planting and expecting profitable crops of a second flush and delaying uprooting. From 2,400 plants, boll counts showed an average of only seven bolls per plant, whilst flower production averaged 25 per plant. Of these seven bolls according to the above-quoted percentage figures, only about three were undamaged per plant. These observations were made on a 12-acre field planted at three periods between the beginning of January and February. The average yield was 117lbs. per acre, of two types of cotton, local and U/4/4/2; the figures are nevertheless indicative of the damage done by pests, fungi, and predisposing physiological causes."

40. The bulk of the crop as in previous years was produced on Ukerewe Island and Mainland. In spite of the adverse conditions the crop reached a total of approximately 7,750 bales as compared with 7,011 bales last year. It was only the enormous increase in acreage which saved the situation and prevented a total failure of the crop. The natives were satisfied with prices and, with the exception of the Bukwimba District, the acreage under this crop will increase, especially in the Musoma and Maswa Districts. U/4/4/2 will again be planted in the Shinyanga District (except Salawe).

41. *Groundnuts.*—The acreage under this crop increased considerably. It is a favourite crop with the native but, unfortunately, owing to the uncontrollable nature of rosette disease, production varies from year to year. It is practically the only cash crop in the Tabora, Kahama and Nzega areas so that the introduction of an immune variety is of vital importance. One bag of the "Basse" and "Philippine White" varieties which are reputed to be resistant have been received from Nigeria and trials are being carried out at Ukiruguru. To supplement the reserves of seed held by the natives the Native Authorities purchased and distributed forty-one tons of seed to natives in the Tabora, Nzega and Kahama Districts. Unfortunately the seed was shelled and in many cases the resultant crop poor. This is attributed to drought, locusts and various other causes while trial planting with seed which has been shelled, bagged and transported, previous to planting, shows that more than 50 per cent. of the seed gets damaged and bruised and fails to germinate.

42. The bulk of the crop is derived from the local creeping variety but the introduced Virginia Bunch variety is increasingly popular. The Virginia Bunch variety is being encouraged as an additional crop. Owing to its early maturity two crops can be harvested per season and it has many obvious advantages over the creeping variety but the natives are not sufficiently advanced to appreciate them. It is considered wiser to plant the creeping variety as usual and an additional crop of Virginia Bunch up to the middle of

February and so extend the planting period for groundnuts. If this practice is followed the production of groundnuts should considerably increase. The results of trials with Virginia Bunch are as follows:—

Planted 5th February, 1932, and harvested on the 17th May, 1932, the yield was 781lbs. per acre.

Planted 1st December, 1931, and harvested 7th March, 1932, the yield was 930lbs. per acre. These were replanted on the 20th March, 1932, and were harvested on the 24th June, 1932, and yielded 463lbs. per acre.

The export figures for the season were approximately 13,379 tons compared with 3,256 tons the previous year.

43. Active steps are being taken to increase the cultivation of this crop next year and ensure adequate supplies of seed. To date the native seed reserves have been supplemented by 14 tons issued to Kahama, 8 tons to Tabora, and 20 tons to Kigoma.

44. *Rice.*—This is a crop ideally suited to Lake shore conditions and one which is increasingly popular with the natives and capable of further development. In the past cotton occupied so much of an agricultural officer's time that the rice crop was neglected. With the posting of an agricultural officer to Musoma particular attention has been given to the cultivation of rice and investigational and selection work has been made possible. All district agricultural officers have been encouraged to make selections and submit them to the District Agricultural Officer, Mwanza. Further trials and selection work will now be carried out at the Mwanza station. Kigoma, in the Western Province, is the main producing area and extensive damage was done to the crops by locusts. Export figures fell from 1,000 to 117 tons. The District Agricultural Officer, Musoma, reports the results of his observations in rice as follows:—

"The soil was sandy with only a small quantity of humus present and water conditions were very variable. Towards the end of the season a rise in the Lake level flooded all plots to a depth of six inches. All seed was first sown in nursery beds and transplanted to the plots when about eight inches high.

Observations on the variety Sena.

Number of days to germination	3-5
Percentage germination	91
Seedlings showed above ground	6-13 days
Number of days to size for transplanting (approx. 8"). ...	48
Number of days to first flowering	116
,, ,, general flowering	125
,, ,, maturity	176
Plot 1.—Sena (selected seed):	
Number of days from sowing to harvest	=177
Yield 17lbs. 15ozs.	=2,012lbs./acre
Plot 2.—Sena (ordinary native seed):	
Number of days from sowing to harvest	=164
Yield 15lbs. 1oz.	=1,687lbs./acre
Plot 3.—Sena (selected seed, Mwanza):	
Number of days to maturity	=178
Yield 20lbs. 2 ozs.	=2,254lbs./acre
Plot 4.—Maji Maji (selected seed, Mwanza):	
Number of days to maturity	=185
Yield 8lbs. 3 ozs.	=950lbs./acre

Plot 5.—Bungala (ordinary native seed) ... ... Failure

Plot 6.—Sindano (ordinary native seed):

Number of days to maturity ... ... =156

Yield 5lbs. 8ozs. ... ... =610lbs./acre

Plot 7.—Sindano (ordinary native seed):

Top dressed boma manure = 2 tons/acre.

Number of days to maturity ... ... =180

Yield 18lbs. 7ozs. ... ... =2,065lbs./acre

Plot 8.—Sena (ordinary native seed):

Top dressed boma manure = 2 tons/acre.

Number of days to maturity ... ... =182

Yield 16lbs. 6ozs. ... ... =1,834lbs./acre

Plot 9.—Sena (ordinary native seed):

Number of days to maturity ... ... =178

Yield 10lbs. 15ozs. ... ... =1,225lbs./acre

"The soil and water conditions were good for Sena but definitely unsuitable for the varieties Maji Maji and Bungala. Although the yields of plots 6 to 9 are not sufficient to prove anything, general growth, etc., indicate that on poor sandy soils an application of organic manure will lead to greatly improved yields. The carrying out of an experiment with sufficient replication and controls is necessary to confirm or disprove this."

45. The District Agricultural Officer, Mwanza, reports: "This crop increases in popularity every year, in Kwimba, especially, as export figures will show, production has increased to replace in part, that of cotton. The sudden mushroom-like growth of rice dams and catchments in Kwimba from April onwards was positively startling. Similarly at the south-end of Smith Sound, and also at Karumo in Uzinza, cultivation is increasing. Maji Maji is the crop of the mainland, the Bungala crop is infinitesimal, except at Kayenze. Sena is planted practically pure in Ukerewe and Ukara, whilst Bungala again is not planted extensively, probably only about 1 per cent., whilst Sena may stand at 30 per cent. It is stated by one of the millers that the quality of Sena from the Islands this year is below standard, owing to early harvesting through fear of locusts. The percentage of broken rice was high whilst ratio of rice to husk was low. On the other hand it is stated that the Maji Maji is above standard and is now in demand from Uganda. The division of the rice crop into its various types Maji Maji, Bungala and Sena, leads one to the conclusion that these are indeed pure products, true to name. This is far from the case, especially in the case of Maji Maji. Had this been so, the natives of Kwimba would have received a supply of pure Maji Maji for their increased planting this year but no pure seed was obtainable anywhere. Three hundred kilos of Maji Maji were selected out in the field from the other manifold types, and distributed to natives of various communities for repurchase after rogueing, by the Native Authority at harvest time. This should supply us with pure Maji Maji which can be exchanged and distributed each year to areas, particularly where rice planting is on the increase or an infant industry, such as in Kwimba, Kome Island and Uzinza."

The total production is estimated at 13,500 tons of paddy compared with 10,000 tons in 1931.

46. *Tobacco.*—The cultivation of the "Heavy Western" type of Nyasaland tobacco was confined to the Biharamulo District. The cultivation of cotton in this district was discontinued and tobacco is now the main economic

crop. Sample bales of first and second grade were sent to London and Liverpool. The total exported was :—

1st grade	...	...	1,823 kilos.
2nd ,,	...	...	1,122 ,,

The total production was approximately five tons. Prices paid were satisfactory and the District Officer is actively encouraging increased plantings.

47. *Sesame.*—The acreage under cultivation of this crop decreased. The main reason is that the native custom is to plant it with their eleusine crop and the fear of locusts made natives plant root crops in preference to eleusine with a proportionate reduction in the sesame crop.

48. *Root Crops.*—The cultivation of cassava and sweet potatoes has been encouraged as an anti-locust measure to prevent famine. The acreage has been considerably increased in all areas and even if the grain crops had been destroyed there were sufficient reserves of root crops to prevent a serious famine. Until the danger from locusts has passed the acreage under these crops will be maintained and increased as a precautionary measure.

49. *Cereals.*—As the areas under root crops have increased the area under grain crops have diminished. The danger of locusts has been ever present and the parasitic plant (*Striga* sp.) has increased to such an extent in some areas that the cultivation of surplus cereals has been abandoned.

50. *Beeswax.*—The collection of beeswax in all non-"sleeping sickness" areas has been actively encouraged. The bulk of the produce is exported from the Tabora District but exports from Maswa, Biharamulo and Musoma are increasing. Beeswax collecting centres where natives are taught to purify the wax by trained instructors before marketing have been established in the Maswa area and will be gradually introduced to all areas.

Pests, Diseases and Vermin.

51. *Cotton.*—Aphis, stainers and spiny bollworm were prevalent but the most serious damage was brought about by "Leaf Crinkle". Whether this was due to the high infestation of Jassid or White fly or both is not certain but the losses caused through this were sufficiently serious to warrant expert attention in the event of a reoccurrence.

52. *Cereals.*—Head smut, grain smut and downy mildew were prevalent in sorghums. The increasing incidence of *Striga hermonthica* and *Striga lutea* has become so serious in some areas that the natives have had to abandon large areas of striga-infested land and in others to change their crops. Anti-striga campaigns were instituted and the employment of special striga guards indicates how serious this pest is regarded by the authorities. *Alectra* (Melasma) *abysinnica* has been found on leguminous crops and *Striga orobanchoides* on wild grasses.

53. *Groundnuts.*—Rosette disease was prevalent particularly in the late planting. The incidence of this disease varies from year to year and from district to district.

54. *Sesame.*—Damage by aphid caused serious crop losses especially where the crop was planted pure.

55. *Coffee.*—A high infestation of leaf curl thrips occurred in the heavy shaded coffee in Bugufi and Kimwani. The principal diseases in Bukoba were the coffee bean borer (*Stephanoderes* sp.) and the coffee bug (*Antestia* sp.).

56. *Locusts.*—The anti-locust campaign was continued. Egg-laying and hopper emergence was reported from all areas lying between 1° and 6° South. The egg-lain areas were smaller and more scattered than in previous years. The organization of the campaign presented difficulties as escapes from uninhabited areas reached the flying stage when the crops were ripening and there were certain differences of opinion as to how the campaign should be conducted. A policy of "every man for himself"— that is, abandoning concerted action and allowing every native to defend his own shamba — is impracticable and if applied would defeat its own end. The campaign was organized along the lines of the previous campaign. Concerted action against hoppers on the part of all natives within a limited radius was recommended. No natives were taken sufficiently far away from their homes that they could not return quickly to protest their own if the occasion arose. The increased planting of root crops reduced the risk of famine to a minimum. The migratory locust showed a marked preference for grass and only in exceptional cases damaged cash crops. Operations against hoppers in uninhabited fly-infested bush country and in uninhabited waterless areas were impracticable. Escapes from these areas and also from neighbouring Territories constituted a grave danger and in consequence the expenditure of large sums of money for local operations, the results of which could be negatived by fliers, could not be recommended.

57. Prompt action was taken by the officers in charge of the numerous local campaigns and all officers co-operated and assisted when necessary. Considering the extent and magnitude of the infestations comparatively little damage was done and great credit is due to all officers and to the Native Administrations for the successful manner in which the campaign was conducted.

58. The following crops were readily eaten particularly in the young stage :—

Sorghums and Millets.
Eleusine.
Maize.

The following crops were touched in exceptional cases. (Considerable damage was done to rice in localized areas but was not general) :—

Rice.	Groundnuts.
Cotton.	Banana leaves.

The following crops were untouched :—

Sweet potatoes.	Sesame.
Cassava.	Pumpkins.
Gram.	Cucumbers, etc.
Beans.	

59. A summary of the locust position by districts is given below :—

Bukoba.—Early in the year a successful campaign was carried out in Missenyi, Karagwe, Kiziba and Bugabo areas. To date egg-laying has been reported in Missenyi, Karagwe and Kiziba areas and the presence of numerous large hopper bands on the Bukoba-Uganda border has been confirmed.

Shinyanga.—A three-day campaign was organized in which the Director of Tsetse Research, the District Officer and all Europeans on the station took part. It is estimated that 100,000 natives turned out and cleared the district of hoppers. Later infestations were successfully dealt with by the use of

zinc bands. To date small scattered outbreaks are reported but the position is well in hand.

Nzega.—Emergence of hoppers began in January. The Agricultural Officer was assisted by officers of the Administration, Education, Public Works and Veterinary Departments and by a detachment of the 2nd Battalion, the King's African Rifles. By the end of February the district was cleared of hoppers. Fliers coming from the Wembere endangered the crops in March and April but in May the district was clear. To date egg-laying and hopper emergence, on a small scale, have been reported.

Kahama.—Hopper emergence was reported in January. The local administrative officers organized an effective campaign. Flying swarms constituted a grave danger during February. To date swarms of mature locusts have been present in the district for the past two months and small areas have been egg-lain.

Tabora.—Egg-laying and emergence of hoppers took place in January and flying swarms were prevalent in March. The district was reported clear in April. The Officer Commanding the 2nd Battalion, the King's African Rifles, took a great personal interest in the campaign and small detachments of the King's African Rifles were employed in anti-locust measures. No further egg-laying has been reported to date.

Kigoma.—In January and February egg-laying and hopper emergence were general in the Ujiji and Luiche areas; Nyaruonga, Buyunga, Mabama and Kasana in Northern Kibondo; Luguru and Heru Chini in Kasulu and along the railway line from Kigoma to Malagarasi. Flying swarms are numerous in the above areas but no egg-laying has been reported to date.

Ufipa.—Extensive infestations occurred in this district especially on the Plateau, Rukwa valley, Mpimbwe and Kasanga areas. Swarms arrived from the north and also from Northern Rhodesia and hopper emergence continued until April. Swarms of mature locusts were prevalent until August. No further egg-laying has been reported to date but red-winged locusts (*Nomadœris septemfasciata*) have been reported from Namanyere.

Maswa.—Egg-laying and emergence of hoppers were general in all parts of the district and an energetic campaign was conducted from January to the end of April.

Musoma.—Egg-laying and hopper emergence were reported in the Ikoma area early in the year and a campaign was started on the 6th January and lasted until the 23rd February. Further egg-laying took place in February in the Ikizu, Zanaki and Ushashi areas and the campaign was continued until the end of April. Active measures were taken against hoppers and fliers to protect the valuable rice crop at Majita.

Mwanza.—Isolated swarms of flying locusts have been prevalent throughout the year. From January to April active measures were taken against hoppers in all areas. Ukerewe island and mainland were the most heavily infested. No further egg-laying has been reported to date.

60. *Methods used to Combat Locusts: Zinc Bands.*—Trials with zinc bands proved successful but they were received too late to be used in any extensive operations. I should say that the use of zinc bands was the most economic and effective method of dealing with hoppers.

Contact Spraying.—This was the most effective of all other methods used against hoppers. Barriers of brushwood or trenches partly filled with brushwood to impede the progress and mass the hoppers helped considerably to make spraying more effective.

Other methods used such as baiting, dusting with arsenite, flame throwers, etc., proved either ineffective or too expensive for large scale operations.

61. The advantages of the use of zinc bands over spraying are obvious. Apart from the initial cost of the spraying equipment, rubber hose deteriorates rapidly in the tropics and large supplies of water and poison, which necessitates the use of motor lorries or large gangs of labour, are essential for successful spraying. In addition to this, the use of large quantities of poison by natives is always an irksome business for the officer conducting operations. Zinc bands are easily erected and can be used in any field independent of water or poison supplies. A few natives are all that is necessary to erect the zinc bands, dig the trap pits and keep the surface of the zinc polished to prevent the hoppers getting a footing and climbing over. With a modicum of care the zinc bands should last for years and, apart from the initial cost, there should be no further expenditure.

62. *Vermin.*—Good work has been done by the Agricultural Instructors in all areas in controlling vermin. Large numbers of porcupines and monkeys have been poisoned.

Legislation.

63. *Cotton Uprooting and Burning.*—The final dates were :—

Lake Province (except Ukerewe Island).—30th September.

Ukerewe Island.—31st October.

Cotton Cess.—The rate was fixed at Sh. 1/- per hundred pounds of lint.

Coffee.—The Produce Export (Bukoba Coffee) Rules, 1932, came into force on the 1st April.

Re-afforestation.

64. The work outlined in the previous annual report has been continued and increased. Trial plots of wattle and increased plantings of Eucalyptus trees are recorded in the Bugufi District.

Roads and Communications.

65. See Annual Report for 1931.

Administrative Changes.

66. In August the Shinyanga District was transferred complete to the Lake Province.

67. Kibondo and Kasulu Districts were closed and absorbed into the Kigoma District.

68. In September the Usega Federation of the Maswa District, comprising four chiefdoms with a total population of 28,394 natives, was transferred to the Mwanza District.

Agricultural Shows.

69. Two successful District Agricultural Shows were held during the year. The Maswa District organized the first show of this kind in 1931 and held the anniversary this year. Bukwimba District organized its first show this year.

70. Both shows were highly successful. The department exhibits were well arranged and most instructive.

71. At the Kwimba Show the quality of the produce was by no means high as the natives had not grasped what was wanted. I think that the competitive sports, relay races, tug-of-war, archery and spear throwing made them realize that their agricultural produce was judged on the same lines and that only the best got prizes. The improvement in the quality of produce entered for the Maswa Show over that of the previous year was most marked.

72. So much enthusiasm and interest has been aroused by the Annual District Shows that it has been decided to hold a Provincial Show in Mwanza next year.

Conclusion.

73. At the beginning of the year pessimism engendered by the world wide depression was deep rooted in Agricultural communities and the only way to eradicate it was to present the most ambitious and optimistic programme of field work that had ever been attempted. For reasons of economy our staff was reduced to a minimum but the willing and helpful co-operation of officers of the Administration and other departments made it possible to fulfill our programme. The results of our efforts have not been always up to expectations but they are sufficiently gratifying to encourage further effort. I feel that this report would not be complete without a word of praise for the Native Administration who through their co-operation and material assistance were largely responsible for the executive side of the work.

A. S. Richardson,
Senior Agricultural Officer,
i/c North-Western Circle.

ANNEXURE III.

THE SOUTH-EASTERN CIRCLE.

Lindi Province.

The reorganization of administrative groups brought the Songea District into the Lindi Province whose boundaries are now the same as the South-Eastern Circle of this department's organization. The staff consists of one Senior Agricultural Officer, at Lindi, with three District Agricultural Officers for the Lindi-Mikindani District, the Masasi-Tunduru Districts and Songea District respectively, and one Agricultural Assistant stationed at the Mpapura agricultural station. Owing to reduced staff it was not possible to post an officer in the Kilwa District. There was a staff of twenty-five African instructors, with ten native assistants employed on the tobacco work.

2. *Weather conditions.*—In the Lindi Province, the portion of the Territory most remote from the equator, there are not two distinct rainy seasons, the rains normally break in December and continue more or less until their cessation in April to May. The rains for the 1932 season broke three weeks earlier than usual, and although the total precipitation was normal, the distribution was uneven, and there were long dry periods unfavourable for the production of grain-crops, exports of which suffered to some extent. Where preparations for planting were well advanced, however, good crops of rice and sorghums were obtained. Such crops as sesame, cotton and groundnuts are planted late in the season, and the climatic conditions were suitable for their growth.

3. *Production and Development.*—The young fire-cured tobacco industries of Masasi and Songea are stated to have taken a good deal of the time of the District Agricultural Officer concerned, close supervision being necessary for the production of the high quality which is essential for tobacco to-day. The plant-more-crops campaign appears to have been mostly devoted to an increased production of sesame and an adequate food supply, which, while yields were below normal, was generally attained, but with decreased exportable surpluses, except in the south-eastern portion of Masasi where resort to famine relief became necessary. Very little cotton was planted.

4. Natives of the coastal districts of the Lindi Province have depended mainly on sesame as a cash crop. It is imperative that they embrace, with a little more enthusiasm, the other cash crops such as cotton and groundnuts, and to show more energy in increasing output, so that the area may be relied upon to make its rightful contribution to the wealth and exports of the Territory, and at least in proportion to areas less favoured as regards soil, climate and costs of transport to the port of exit. A summary of exports for the years 1932 and 1931 is given below :—

Produce	1931 tons	1931 value £	1932 tons	1932 value £
Sisal ...	6,665	74,111	7,240	72,286
Sesame ...	2,841	28,947	3,970	42,816
Sorghum ...	3,531	15,354	1,960	8,196
Rice ...	1,211	9,564	848	7,885
Bark ...	—	6,838	210	519
Beeswax ...	78	6,137	62	6,555
Copra ...	488	3,847	887	7,676
Groundnuts	375	3,319	296	3,178
Tobacco ...	120	2,965	44	1,168
Gum Copal	36	1,633	19	1,030
Cotton lint	34	1,440	10	448
Sesame oil	—	—	27	1,060
TOTALS ...	15,379	154,155	15,573	152,817

CROPS AND CULTIVATION IN DETAIL.

5. *Sisal.*—The remarks regarding sisal, previously made in this report, apply to Lindi as elsewhere. Production increased from an export figure of 6,665 tons in 1931 to 7,240 tons for 1932, which is almost twice the export for the year 1929.

6. *Sesame* was the outstanding crop throughout the province, and a record export of 3,970 tons was attained. The crop appeals to the native grower and prices were good. Twenty tons of seed have been purchased, largely from Native Authority funds, for extension of this crop, which is one well suited to mixed cropping; especially with millets under the local conditions. An attempt is being made to improve the quality of the well-known "Lindi White" sesame, but an obstacle to this is the refusal of local merchants to pay for quality. An oil-extraction plant was installed at Mikindani.

7. *Copra.*—Exports of copra while still lower than they ought to be were doubled over the previous year, prices were better.

8. *Grain Crops.*—As explained above, weather conditions were adverse to late sown grain crops, as a consequence of which both yields and exports were down. "Kenya Governor" wheat is now extensively grown in the Matengo Highlands of Songea, and it is to be hoped that further extension will take place and that wheat will become part of the daily diet of the native.

9. *Groundnuts.*—An increase in the area of groundnuts in the hinterland districts was not reflected in better exports which were in fact down by some 30 per cent., the produce being consumed as food owing to the failure of the grain crops.

10. *Cotton.*—But ten tons of seed-cotton was produced by natives in the coastal area.

11. *Beeswax.*—There is a decrease in the amount of beeswax exported: 62 tons being the figure for 1932 against 78 tons for 1931, although prices paid were better than in the previous year.

12. *Tobacco.*—Considerable importance is attached to the native tobacco industry of Masasi and Songea. There was, however, a large decrease in the dry season production of native roll tobacco, 40 tons being exported in 1932 as compared to 120 tons in 1931. This is partly accounted for by floods and by dry season tobacco lands being put under food crops.

13. Seven tons of fire-cured native tobacco, grown as a rain crop, was produced from the Masasi and Songea Districts, from Heavy Western seed. All marketing functions, including buying, grading, baling, transporting, shipping and selling, are carried out by the department, the leaf being bought outright from the native grower and sold direct to the tobacco manufacturers in Dar es Salaam at a small profit. Progress has been slow, and in this connection the District Agricultural Officer, Masasi, reports as follows :—

> "The production of this tobacco has entailed a great deal of propaganda work and very close supervision, and has hence occupied a major portion of the time of the District Agricultural Officer and his staff. At first sight it might appear that the amount of tobacco produced hardly justifies the expense that has been entailed. But it must not be forgotten that fire-curing and wet season tobacco are, to the local native, revolutionary ideas, and it is to be expected that several seasons must pass before the barriers of conservatism and suspicion are demolished by the 'battering ram' of good cash returns. This is only the first season of wet weather tobacco. Already, interest is widespread, and there is every indication that the wet season crop of 1933 will be more than double that of 1932. In fact there is some justification for the belief that there has been formed the makings of a live new industry, which, given time and a steady market should well repay the expense of its foundation."

14. *Coffee.*—Arabica coffee planting by natives has increased without any applied stimulus in the Songea District. While general conditions in the Matengo Highlands are not ideal for this crop, suitable localized areas can be found. Rules to be enacted under the Native Authorities are under consideration for the better control of plantings.

15. *Root Crops.*—Substantial increases in the areas under cassava and sweet potatoes are reported from all quarters in response to measures adopted in co-operation with administrative officers, both as a precaution against locusts and the famines which occur periodically.

Experimental Stations and Seed Farms.

16. Work at the Mpapura Experimental Station has been concerned mainly with varietal trials of native food and cash crops, details of which are given in a separate report.

17. There are five seed farms situated, one in each of the Lindi, Masasi, Tunduru areas and two in Songea. The Masasi seed farm was utilized for the multiplication of White Sesame and Virginia Bunch groundnuts, which is more resistant to Rosette disease than the indigenous kinds. Experimentation with Heavy Western tobacco was also carried out with the conclusions that (a) planting before the rains have broken is risky ; (b) late planting (up to the end of January) is somewhat detrimental to quality but not yield ; (c) a red loom soil is preferable to either a black or a sandy soil.

18. The Tunduru seed farm of eighteen acres was devoted to the multiplication of Potchefstroom Pearl and Bushman's maize and to Virginia Bunch groundnuts ; the soil fertility is low however, and yields were poor.

19. The Lindi seed farm in the Mwera area was increased to twenty-three acres ; White sesame, Virginia Bunch groundnuts and Kenya hybrid maize were grown. The maize was particularly successful and is regarded with increasing favour by the native grower.

20. The Songea farms were similarly used for groundnuts and maize seed production.

21. School gardens (five) and model plots of the African instructors have proved useful as demonstrations.

22. *Soil Erosion.*—Demonstration of anti-erosion measures have been continued at Mikindani, Mpapura, Lindi, Masasi, Tunduru and Songea. In the latter district the Wamatengo have an excellent method of saucer or platform terrace cultivation which has been followed on the steep hillsides for many generations.

23. *Pests and Diseases.*—The province has been singularly free of any serious infestation although leaf-eating beetles have occurred to some extent on pulses and sesame, and maize-borer caused the usual damage to maize and sorghums. Rosette disease exists to some extent in all areas. A suspected Fusarium wilt on pigeon peas has caused some losses in Songea and is being investigated.

24. Flying swarms of locusts occurred in Kilwa, Lindi and Songea after the main crops had been harvested. Songea was heavily invaded in the latter part of the year from the north-west. Extensive damage is caused to many crops by wild pig and monkeys throughout the province, and the usual amount of damage by game, although generally restricted, has been in some instances severe.

25. *Marketing.*—Under the Trades Licensing (Amendment) Ordinance, the following crops were declared to be saleable for cash only: Tobacco, sesame, beeswax, rice, and groundnuts (the latter excepted in Songea), also millet in Songea only. Cash marketing has given an added impetus to the production of economic crops, and it is hoped that with energetic measures there will be an improvement in the near future in the economic position of the Lindi Province. The present methods of marketing the sesame crop are held to be unsound, no premium being paid for quality; the matter is receiving consideration with a view to introducing ameliorative measures.

ANNEXURE IV.

REPORT OF THE ENTOMOLOGIST, 1932.

Plant Importation, etc.

Sixty-two permits were issued under Plant Pest and Disease (Import) Regulations.

2. One hundred and twenty-three sets of samples of cleaned coffee (representing 984 packages) have been examined at the laboratory upon re-admission to the Territory from coffee cleaning works in Kenya Colony and abroad as a measure for exclusion of the coffee bean borer, *Stephanoderes hampei*, Ferr.

5. Evidence was given in two cases of contravention of the Plant Pest and Disease (Import) Regulations.

4. One commercial nursery for the production of fruit trees and garden decoratives has been established in the Northern Province near Arusha.

5. The sweet potato weevil, *Cylas formicarius*, F., was intercepted at Mwanza in Uganda potatoes. *C. compressus*, Hartm., is the common form of Cylas of the Territory. Apples from Japan showed intense injury from Codling Moth, *Carpocapsa pomonella*, L., but no live stages of the pest were present. Correspondence has been passed with a company entertaining business in export of mango fruits. The mango fruit pests of the Territory include the weevil *Cryptorhynchus mangiferæ*, F., and the fruit flies *Ceratitis capitata*, Wied. and *Pterandrus rosa*, Karsch. Protection from storage pests of cashew nuts (*Anacardium occidentale*) prior to packing and shipment has been receiving the attention of coastal shippers. The bamboo beetle, *Dinoderus minutus*, F., has invaded cotton goods in Dar es Salaam godowns where bamboo slats had been used as bale protection during course of shipment.

Pests.

6. *Pests of Sisal.*—The Mexican sisal weevil, *Scyphophorus acupunctatus*, Gyl., originally reported for Deutsch Ost-Afrika in *Der Tropenpflanzer*, xxiv, 1921, which bred up to considerable numbers in the neglected sisal plantations of the Territory during the war-period and subsequently until plantations were developed again has, as a consequence of the slump in sisal prices and work of estate sanitation being somewhat in abeyance, again come into prominence during the year. The weevil breeds freely in the senescent or decaying poled materials which under a normal system of plantation sanitation are regularly removed and burned or vertically slashed open to permit of rapid drying out. The adult weevil is responsible for the economic damage to sisal, gnawing into the central unfurled leaf-spike towards its upper third in round and oval tunnels to feed upon the softer leaf pulp. The tunnelling of the weevil severs the fibre, leading to waste in the factory brushing process, to brown stain of fibre, and to brown roughnesses on the fibre which the brushes fail to remove. Secondary fungi may invade the spike at points of weevil attack and complete decay set in down to the plant base wherein the weevil may oviposit and breed but, as a general rule, breeding is confined to poled

sisal bases. Attack of this pest on *Agave Americana*, var. *variegata*, is extremely disfiguring and decidedly detracts from the appearance of this fine tropical decorative. The pest in its relation to sisal industry may, however, be ranked as of minor importance when normal plantation work and a fair market pertain.

7. *Pests of Pasture.*—During February-April, the season of normal prevalence of the Army-worm, *Laphygma exempta*, Wlk., throughout the Northern Province of the Territory, losses in bovine stock were reported; death was purported to have been caused by ingestion of army-worm caterpillars. An opportunity for examination of viscera post-mortem has not presented itself to officers interested. Army-worm occurs over the length of the African continent in season and there is no statement in literature associating ingestion of the caterpillars with stock poisoning or death. Ingestion of the spiny slug caterpillars of Parasa have also been associated in the native mind with deaths in stock, particularly goats, *vide* Report 1924-25, p. 42, a story which may have an element of truth as such hairy or spiny caterpillars are capable of setting up at times in humans serious urticaria accompanied by temperature. The army-worm is, however, an absolutely smooth caterpillar and the writer is inclined, as an hypothesis, to attribute the deaths of stock reported to vegetable poisoning from ingestion of foliage of some bulbous (or other) plant as the season of occurrence of army-worm coincides with the early rains when, throughout the cattle areas, there is a spring of innumerable bulbous weeds.

8. According to information received from the Amani Botanist (Mr. P. J. Greenway), there occur in the Northern Province cattle plains in the family Liliaceæ: *Urginea* spp. var., *Gloriosa virescens*, *Bulbine asphodeloides*; in the family Amaryllidaceæ: *Hæmanthus eurysiphon*; and in the family Iridaceæ: *Morœa iridioides*, etc. He also considers that, amongst Dicotyledons of the area, species of the following genera may be implicated in stock mortality: Dichapetalum, Cassis, Crotalaria, Mundulea, Tephrosia, Melianthus, Solanum, Hermannia, Gnidia, Aristolochia, etc. Natives also associate deaths in stock, particularly goats, with the presence of a common smut, *Sphacelotheca* sp., on the grasses Cynodon and Chloris spp.

9. *Pests of Maize.*—The main crop maize of the Northern Province continued to enjoy a notable freedom from economic damage by the stem and cob borer, *Busseola fusca*, Fuller. With the present low prices of maize, there has been an increased interest in improved methods for mass storage of maize grain.

10. *Pests of Tobacco.*—The tobacco bud-worm, *Pthorimœa heliopa*, Lw., has caused serious damage to tobacco nurseries. The infestation of the nurseries was attributed to infested old and ratooning tobacco fields in the vicinity of the nurseries. Maintenance of a plantation of tobacco of an even age (main-crop) is advisable and destruction of crop residues and field sanitation at conclusion of crop season as for cotton.

11. *Pests of Coffee.*—The Humming Bird Hawk Moth, *Cephonodes hylas*, L. During the period February-March, the Arabica coffee of the Northern Province received the first attentions of this pest during the writer's tenure of office (i.e. since 1921). Particularly severe defoliation was experienced on one plantation in Western Arusha. As the period of seasonal occurrence coincides with the period of activity of thrips, planters were advised to incorporate arsenate of lead with the later lime sulphur spray or with the

premasika Bordeaux Mixture Nicotine combination spray, *vide* Report of 1931, p. 85. Where however, arsenicals are not available in quantity, hand-picking of the caterpillars must be undertaken to minimize the caterpillar damage and prevent serious set-back to the plantation. The moth can regularly be observed in coffee plantations, being in considerable numbers particularly at coffee blossom periods and why it should not generally elect to oviposit on coffee is a matter not understood. The potentiality of the pest for wide-spread damage to coffee interests must be clearly realized and its occurrence even when in small numbers be taken as a warning of possible greater happenings.

12. The White Coffee Stem Borer, *Anthores leuconotus*, Pasc. This pest has been the subject of major investigation during the year. Correspondence upon the subject has been entered into with entomologists throughout the African continnent. The investigation is still in train but the following summary of observations is meanwhile given.

(a) *The make-up of the coffee tree.*—Single stem is advisable for simplicity of inspection and treatment. The crotches of multiple stemmed trees provide favoured points for oviposition.

(b) *Treatment of coffee trees.*—The following plantation procedure badly done tends to provide irregularities which are favoured for oviposition: capping, removal of gormandizers, late removal of multiple stems; all nature of stubs or nubby out-growths must be avoided. It is oviposition at such points which is very often missing by labour or which, if detected, occupies unnecessarily long time for extraction of resulting grubs.

(c) Oviposition occurs in major degree behind the bark at ground level. There is no evidence of oviposition below ground level. It is the grubs from eggs laid at this point which proceed in the superficial root tissues below ground. Hand grubbing of such deep grubs necessitates the exposure of the root system close up to the central tap root. Means of protection of the stem at and just above ground level is subject of experiment. Protectives may be mechanical (aluminium shields, roofing felts, chemically treated papers, etc.), *or* chemical (lime sulphur, 32° Beaumé, one in ten of water, made to a paste with lime, Bordeaux paste, etc.). A satisfactory protective which will render below ground examination of coffee roots safely unnecessary will cut hand grubbing costs by at least seventy-five per cent.

(d) Determination by planters of the period of flight of the adult borers in their district is most important. Hand grubbing should commence at a date in relation to this flight period so that resulting grubs will have reached a size detectable by the borer inspection gang (grubs in the fourth month from time of observed flight of beetles will show slight raised bark disturbance or slight vertical cracking of bark with emission of short fibre or brown dust, e.g. observed flight May, grub work September onward; too early a beginning will mean missing many small undetectable grubs). The borer gang should be provided with (i) a piece of rough Hessian or old coffee bag for rubbing the bark of trees to reveal and clean borer grub workings; (ii) a foot of iron wire mounted on a three-inch piece of coffee twig, gauge No. 24 or No. 22; and (iii) a small file to keep the wire point well sharpened. Large wires like No. 20 and No. 18 are only necessary in neglected coffee where large grubs occur.

(e) The use of chemicals like paradichlorbenzene for insertion in borer grub holes is not recommended except in instances where extraction is impossible save by sacrificing the entire tree or considerable sections of it.

(f) Coffee in a borer area when stumped back to near ground level must even though showing a clean saw-cut be thoroughly examined below ground. Grubbing old stumps to a hundred per cent. clearance is extremely difficult for native labour and, in the opinion of the writer, such old material is advisedly uprooted.

(g) The following trees have been determined as wild alternative hosts of the borer, adult borer beetles having been reared in the laboratory from infested stems :—

Oxyanthus speciosus, D.C. ... Native name : Mrali, Elimanubi, Kahawa ya Porini.

Randia sp. ... ... Native name : Mbuchi, Mroyo, Mdengedenge.

Further suspect hosts are under study. Such alternative host plants occurring in the vicinity of coffee plantations should be uprooted and burned. The determination of the adult beetles reared from these wild hosts has been confirmed by the Imperial Institute of Entomology.

(h) Up to the present when the investigation has been confined to the Northern Province, there is an observed absence of forms of life predatorial or parasitic upon the pest in its various stages.

(i) Cages have been set up in the field for determination of the complete life-cycle period.

13. *Coffee Leaf-Miner, Leucoptera coffeella*, St.—The northern coffee areas experienced the worst onset of this pest ever observed by the writer during the year, the pest effecting an almost complete defoliation on many plantations by middle November. The discomfiture of the plantations was accentuated by a very hot November and an absence of rains. Twig die-back has resulted where the terminal foliage of the primary and secondary branches went entirely. A noteworthy point is that those plantations or those sections of plantations which had received the full coffee spray programme, *vide* Report of 1931, p. 85, show interesting results. Where coffee was protected by Bordeaux Mixture from defoliation by Hemileia, the trees immediately the rains set in in December quickly replaced leafage lost as a consequence of leaf-miner but coffee which experienced the double defoliation of hemileia followed by miner is still in extremely bad condition indeed, being practically minus good leafage. The results emphasize the wisdom of the advice steadily given by the department that the combat by adequate spraying of pests and disease which jeopardize leafage and the steady maintenance thereby of leafage is of paramount importance in coffee production. Spray-protected coffee blocks in spite of leaf-miner attack are again set for a heavy bearing.

14. Further observations have been made on leaf-miner parasitism, following upon that reported in the Report for 1931, p. 83.

15. Miner moth can be readily killed by application of dusts impregnated by pyrethrum extract but several applications would be essential to dispose of the recurring emergences of moth. One pound of dust is required for from thirteen to fifteen average size coffee trees and, at present prices, the use of such dusts is not within the realm of economic practice, particularly on top

of the present pest and disease budget (approximately thirty shillings per acre) and bearing in mind prevailing coffee prices. Thanks to co-operative effort by manufacturers, the dusts available are now satisfactory both as to physical and lethal properties, *cf.* Report for 1931, p. 85.

16. *Coffee Bug, Antestia lineaticollis*, St.—There has been a welcome response made by planters to departmental recommendations made for the better control of bug, details of which were given in the Report for 1931, p. 84. Care and attention to the finer points of application with correct apparatus show that planters can reduce scorch from the arsenite of soda and sugar bait to the nigh invisible. Experiments are, however, being undertaken with the new colloidal forms of arsenate of lead with a view to procuring a poison safer on coffee foliage provided that comparatively with arsenite of soda it is equally lethal to bug. It is gratifying to report that, during the past crop, crop losses even in formerly heavily bug-infested plantations have been brought right down by the bait treatment where correctly and determinedly applied. All evidence goes to show that a stung crop is attributed not to any flaw in the method itself but in the manner of its application.

17. Miscellaneous new determinations of Territory pests :—

Coccidæ :

Aspidiotus elæidis, March., on Ceara Rubber.

Hemiberlesia lataniæ, Sign., on Guava.

Thysanoptera :

Actinothrips ritchianus, Bagn, (sp.n.), Tobacco.

Aeolothrips varicornis, Bagn. (sp.n.), Onion.

Haplothrips articulosus, Bagn. (sp.n.), Sunflower blossom.

Elaphothrips nigrispinosus, Bagn. (sp.n.), ?.

Dr. Ferriere of the Imperial Institute of Entomology has indentified the hymenopterous parasite of the red thrips of coffee, *Retithrips ægyptiacus*, March., *vide* Report of 1931, p. 85, as a species of Thripoctenus, probably new.

A. H. Ritchie,
Entomologist.

ANNEXURE V.

REPORT OF THE ASSISTANT ENTOMOLOGIST, 1932.

1. *Staff.*—The Assistant Entomologist was absent from the Territory on vacation leave from 6th June.

2. *Leave activities.*—The Assistant Entomologist was the official delegate of the Territory to the Fifth International Congress of Entomology, held at Paris in July. He attended the Midland and South-Western Convention of Bee-Keepers at Cardiff in August, contributing a paper on "Native Bee-keeping in Tanganyika Territory". An exhibit representative of beeswax and honey production in the Territory was staged at the National Show of Bees and Honey, in London during September. Visits were paid to brokers and manufacturers interested in beeswax.

He is indebted to members of the following institutions for advice and assistance: the Imperial Institute of Entomology, the Imperial Institute, the Zoological Department of the Natural History Museum, the Rothampsted Experiment Station, and the Ministry of Agriculture's Technical Advisers on Bee-keeping and Rodents.

3. *Tea Pests.*—The following insect pests of tea in Mufindi and Tukuyu require to be added to the list given in the last report:—

Thrips *Heliothrips hæmorrhoidalis*, Bouche., Thripidæ.

Leaf-weevil *Lixus discolor*, Boh., Curculionidæ.

4. *Coffee Pests.*—The Tailed Coffee Caterpillar which attacks coffee foliage in Bukoba has been identified as *Metadrepana marantica*, Tams.

Leaf-eating Beetles from the south-west include the weevil *Dicasticus funicularis*, Clev., and the Criocerid, *Bradylema robusta*, Lac.

The Red Thrips found on coffee, and referred to in the last report, is *Retithrips syriacus*, Mayet, not *R. ægyptiacus* as stated.

5. *Cotton.*—The Chrysomelid Beetle, *Mesoplatys ochroptera*, Stal., was found attacking cotton foliage at Shinyanga. A second species of Jassid, *Empoasca benedettoi*, Paoli (*Paoli, Mem. Soc. Ent. Italiana*, XI, 1932, p. 115) is recorded from the same locality.

The results of boll examination in the Morogoro District during the season are summarized below:—

Month	Bolls No. examined	Locules			Platyedra per 100 locules
		Sound %	Bollworm damage %	Stained %	
July ...	1,700 ...	55·1 ...	20·7 ...	24·2 ...	12
August ...	3,800 ...	53·9 ...	22·1 ...	24·0 ...	14
September ...	3,850 ...	50·0 ...	29·1 ...	20·9 ...	25

The degree of infestation by Pink Bollworm was exceptionally heavy in July, due more to the increase in larvæ per infested locules than to the increase of locules attacked. Pupation in the boll was observed to a greater degree that hithertofore during the same month.

An African collector visited the new cotton growing areas of Kiberege and Ifakara, Mahenge District, during August. Insect pests were few in number. Boll examination resulted as follows :—

	Bolls	Locules			Platyedra
	No. examined	Sound %	Bollworm damage %	Stained %	per 100 locules
Kiberege ...	400 ...	61·8 ...	1·3 ...	36·9 ...	1
Ifakara ...	900 ...	68·5 ...	1·2 ...	30·3 ...	0·5

Stainers, *Dysdercus* sp., were not in evidence to account for the high incidence of stained locules. Pink and Spiny Bollworms were few in number. No other bollworms were found.

6. *Food Crop Pests.*—The weevil attacking Pigeon Pea foliage in the south-east is now identified as *Gyponychus quinquemaculatus*, Hust.

The foliage of Butter Beans (*Phaseolus* sp.) was severely attacked in Tukuyu by beetles of the following genera : *Systates*, *Bruchus*, and *Pagria*.

Developing pods of the Earth Nut, *Voandzeia subterranea*, were injured by a weevil, *Apion* sp., in parts of Bukoba. In the same district considerable wilting of Cow Pea, *Cajanus cajan*, was noted, owing to ring barking by the long-horned bettle *Ceroplesis signata*, Waterh.

7. *Locusts.*—The tracheal mite found infesting *Locusta migratoria migratorioides*, to which reference was made in the report for 1931, has been described by Dr. H. E. Ewing as *Locustacarus locustæ* sp. nov. (*Proc. Biological Soc.*, Washington, 45, p. 99, 1932). This is only the third mite to be recorded from the tracheæ of insects, the two previous records being *Locustacarus trachealis*, Ewing, a parasite of grasshoppers in the United States of America, and *Acarapis woodi*, Rennie, the cause of "Isle of Wight Disease" in honey bees.

Further specimens of *L. locustæ* were obtained from a small swarm of senile migratory locusts passing Morogoro early in the year. No mites have been located so far in hoppers or in young adults.

8. *Apiculture.*—The export of beeswax from the Territory during 1932 was 7,820cwts., valued at £31,955. The amount exported is a very close approximation to the average figure for the last ten years, 7,798cwts. It is pleasant to record that the average value at the coastal ports of 82 shillings per cwt. has shown an increase of Shs. 5/- over the 1931 figure.

The dependence of bee-keeping on climatic conditions has been demonstrated in many honey producing countries. In Tanganyika where wax production is the index of bee activity, the same has been shown to be true over the period 1922-31.

(*Trop. Agr.* IX., p. 231, 1932).

"The rainfall for Kahama (a station near the centre of the Tabora wax area) is graphed as indicative of the climatic conditions under which the great proportion of the wax is produced. It will be seen that a striking correlation exists between the wax production and the rainfall of the preceding year. It would therefore appear that, since most of the rain in the year falls before the wax harvest, the effect of increased rainfall is to increase the swarming powers rather than the actual amount of wax produced, and that there are in consequence more colonies available to survive the bush fires and drought of the following dry season."

The figures for wax production, and the rainfall for the preceding year are given below :—

Year	Wax production	Rainfall at Kahama in preceding year mm.
1923	6,039 ...	883
1924	8,496 ...	1002
1925	5,858 ...	739
1926	6,147 ...	1040
1927	11,169 ...	1171
1928	9,815 ...	849
1929	6,721 ...	715
1930	3,773 ...	936
1931	12,143 ...	1293
1932	7,820 ...	875

Demonstrations in wax preparation have been given in the Western Uluguru Mountains, Morogoro District. No wax has been produced in this area previously, although bee-keeping for honey production is widely practised.

A native instructor has been posted to the Northern Province from June to December, to demonstrate the Queen-excluder beehive, and encourage wax production.

A considerable number of "Tanganyika" beehives have been produced at the laboratory, and distributed as models. One hive has been supplied for exhibition at the Chicago Centenary Show.

The apiary attached to the laboratory has been maintained, but owing to the continued attention of thieves from the town no experimental data has been obtained from the native hives. Locally made frame hives have been brought into use. An out-apiary higher up the mountain has been established.

A collection of beeswax samples from other countries has been started for comparison with local wax. A study of the pollen and nectar producing plants of the Territory is under way.

Leaflet No. 10, "Beeswax", was reprinted in the *Bee Kingdom* for December, 1931.

9. *Rodents.*—Nineteen species of rodents from Morogoro have been identified to date by the British Museum.

The Grey Field Mouse, *Mastomys coucha microdon*, Peters, was again in evidence in Kimamba and Morogoro. This pest will form the subject of a separate report.

The Root Rat, common in the Morogoro and coastal areas, and on occasion attacking sisal, is identified as *Heliophobius emini*, Noack.

10. *Miscellaneous.*—A cause of the blisters which seasonally disfigure the faces and arms of the less fortunate European inhabitants of Morogoro has been shown to be the Mylabrid beetle *Cylindrothorax strangulata*, Gerst.

W. Victor Harris,
Assistant Entomologist.

ANNEXURE VI.

REPORT OF THE MYCOLOGIST.

1. *Routine.*—Advisory work continues to be the major work of the laboratory, but an increasing amount of that work is being undertaken directly by the field officers. As in former years we have had the assistance of the Imperial Mycological Institute on many occasions, including the identification of fungi submitted.

2. *Extension Work.*—Special efforts have been made to bring the subject of plant diseases to the attention of natives. This work must necessarily be slow, but the progress is satisfactory. In the Morogoro District particular attention has been given to the diseases of cereals. That subject has certain advantages for educational work: cereals are the important native food crops in the district; the diseases are now known, and they may all be controlled at little or no expense. Six lectures and demonstrations were given, in English and Kiswahili, at the laboratory or in the field. Through the active support of the local Administration, the Mission stations and European planters, besides the agricultural officers, many influential natives were thus addressed. These natives included the African instructors of the department, the local chiefs, and native teachers and senior boys of the schools. The information has also been issued in leaflets or circulars in English and Kiswahili, and also printed in *Mambo Leo*. The work finally passed largely into the hands of the District Agricultural Officer and his instructors. Other districts have also been active in demonstrating disease control to natives, e.g. in the Kilosa and Singida Districts.

The establishment of small local museums of pathological material has been developed at Moshi and Mwanza by the local agricultural officers. The undoubted educative value of such exhibits justifies their establishment, on however small a scale in all districts. Exhibit jars and cases have been obtained for this purpose.

Of value in extension work is the monthly periodical *The Planter*, the first number of which was published at Arusha by the Northern Province Press in September, 1932. Advantage has been taken of that periodical to publish several mycological items.

3. *Publications.*—"A List of Fungi or Diseases on Economic Plants in Tanganyika Territory" was published in the *Kew Bulletin of Miscellaneous Information*, No. 1 of 1932. Two hundred and fifty reprints were prepared and distributed mostly abroad. The list gives the host plants and fungi observed in the Territory between 1927 and 1930. A further list is being compiled. In *Tropical Agriculture*, IX, No. 4 of 1932, a paper was published entitled "Coffee Bean Disease: Relationship of *Nematospora Gossypii* to the Disease." Mycological Leaflets Nos. 6 and 8 have been combined and extended to seven pages as Leaflet No. 6 (Revised): "Root Diseases and their Control." Leaflet No. 3 on "Brown-eye Spot of Coffee" has been revised and amplified. For the information of planters in this Territory the subject of "Coffee Berry Disease" which occurs in Kenya and which has been described by Mr. J. McDonald, Senior Mycologist, Nairobi, in his Leaflet

No. 4, has been dealt with in Mycological Leaflet No. 12 of this department. There is no record of the disease in Tanganyika so far. Leaflet No. 13 is a popular rendering of the paper by Dr. H. H. Storey, Plant Pathologist at Amani on "A Bark Disease of Coffee" published in the *Annals of Applied Biology*, XIX, No. 2, 1932. The disease is recorded so far only from the West Usambara Mountains. Three circulars have been cyclostyled and distributed: No. 1 on Coconut Bud Rot (in English and Kiswahili); this disease has been observed on the Kenya coastal plantations, but not in Tanganyika. Circular No. 2 on "Diseases of Native Food Crops, I: Cereals" has also been issued in English and Kiswahili. Circular No. 3 gives our present knowledge of "Diseases of Simsim" in this Territory.

4. *Diseases of Particular Crops*: *Coffee.*—*Armillaria* root disease has been observed on a number of plantations in the Usambara Mountains. All the planters in the area have been provided with information on the occurrence and control of the trouble, and although the disease is rather widely distributed, and affects a number of other crops as indicated below, measures are in hand to reduce the amount of infection and prevent spread as much as possible.

Rust (*Hemileia vastatrix*) has been shown at Moshi to be most effectively controlled by two half-strength or one full-strength application of Bordeaux Mixture applied before the disease becomes noticeable, i.e. in March, before the heavy rains commence, followed by one half-strength spray towards the end of the rains.

Brown-eye Spot (*Cercospora coffeicola*) has been particularly abundant on coffee cherries, leaves, and seedlings. It is however definitely less abundant where trees have been sprayed effectively against rust, and in seed-beds where pigeon-pea, for example, has been used to provide shade.

Coffee Bean Disease (*Nematospora Coryli* and *N. Gossypii*). Some forms of injury not yet incorporated in mycological leaflet No. 9 are as follows: the parchment of diseased beans on the drying trays sometimes shows thin brown cracks externally, and may have a brown discoloration on the inner surface. The beans of one diseased lot were yellow inside, but this character is not general. The control of the disease remains an entomological activity.

Bark Disease of Coffee (*Fusarium lateritium* Nees var. *longum* Wr.). This disease was first observed by the Plant Pathologist, Amani. As stated above, the disease is confined as yet to the West Usambara Mountains. The symptoms need not be described here as they have been fully discussed elsewhere (see under publications above). In addition to the control measures tentatively suggested in Leaflet No. 13, a measure which may reduce or prevent infection is that suggested by the Senior Agricultural Officer, Moshi, that is to cut back coffee at the beginning of a period of shoot growth — in early August. That time is suggested as probably better than in March when rains may soak into the top of the stump.

A Diaspid scale insect on robusta coffee was found heavily parasitized by a fungus, *Microcera* sp. In the absence of perithecia the exact species could not be determined.

Tea.—Apart from *Armillaria* root disease, the tea bushes examined on plantations in the Usambara Mountains are exceedingly healthy, but the root disease requires control. It was recommended that if each infection could

not be dealt with individually, infected areas should be isolated by deep trenches and diseased trees burned. *Botryodiplodia Theobromæ* Pat. was seen on some bushes but not of economic importance.

Cacao.—One cacao plantation was visited. The trees are yielding beans of good quality, but pod rot associated with a *Phytophthora* (? *P. Faberi*) was abundant. Two species of *Rosellinia* were observed in small quantity, but their exact identity and significance have not yet been determined. *B. Theobromæ* was abundant on dead twigs and rotted pods; again the significance is not yet determined. A saprophyte on a dead stump was *Kretzschmaria citrarioides* (W. and Curr) Sacc. or Cke. On a dead trunk a *Melanospora* sp. was present. A very common fungus on dead branches and pods is *Nectria striatospora* Zimm. (*N. jungneri* P. Henn.). The diseases of this crop will be further investigated in the coming year.

Cotton.—Further evidence has been obtained of there being no risk, so far as bacterial boll-rot and black-arm are concerned, in sowing seed imported from Uganda. These diseases are endemic in this country but appear to be kept in check by environmental conditions.

Cereals.—Cereal diseases in general have been mentioned above under Extension Work.

So far as *Maize* is concerned, the attention of natives has been drawn particularly to Head Smut and the Ear-Rots (*Gibberella* and *Diplodia* species, including *D. frumenti* E. & E. now recorded). The control methods being advocated are the burning of maize trash after harvest, the practice of rotations, and the selection of seed from sound ears. So far as observation goes in this country, head smut of maize appears to be confined to elevations of 5,000 feet and over. One native plantation at 5,000 feet showed no less than 100 per cent. loss through head smut.

Of the *Diplodia* Ear-Rots, the order of importance (i.e. abundance) is *D. macrospora*, *D. Zeæ*, and *D. frumenti*: the latter has been seen only once on old stalks and once in grains of an ear. Other fungi to be recorded on maize are as follows:—

Pycnidia of *Phæocytostroma ambigua* (Mont.) Petr., an uncommon fungus. It was found on old stalks, and does not appear to be recorded in pathological literature. *Melanconium saccharinum* Penz. and Sacc. on old stalks — apparently the first record of this sugar-cane parasite on maize.

Leptosphæria orthogramma Sacc., on old stalks. *Nectria* sp. at the nodes of old stalks. *Hendersonia* sp. on old stalks, apparently not recorded on maize. *Papularia sphærosperma* (Pers.) von Höhn group, on old stalks. *Mycosphærella* (?) sp. on old stalk. *Clasterosporium lindavianum* Reichert on old stalks, not previously recorded on maize.

On *Sorghum* Downy Mildew causes considerable loss: the variety "Bonganhilo" appears, however, to be practically immune, for no infection was seen among 2,000 plants examined. On the other hand, in an experiment with the local varieties Jebere, Karachi, Bangara and Lugundugundu at Morogoro, the percentages of infection were 9·6, 5·9, 10·8 and 10·7. The average infection for the four varieties in 5,000 plants was 8·9 per cent. The ultimate effect of the disease, without any observed exception, is to kill the plant before ears are produced. The infection among seventy plants of the variety Labonga from Nzega was 12, or 17·1 per cent.; this large infection may not hold in larger counts.

The attention of natives has been drawn particularly to the Downy Mildew and the smuts. The use of sulphur against the latter has been demonstrated, and it is expected that between two and three hundredweights of sulphur will be distributed to natives for seed treatment in the coming year. The cost is small, being less than two cents for one ounce of sulphur — i.e. sufficient to treat 15lb. of seed.

In an experiment with Bonganhilo, four untreated control plots had 3·6 per cent. infection with grain smut among 1,200 plants. Seed treated with sulphur or copper sulphate produced no smutted plants; with copper-carbonate treatment, the infection was 0·5 per cent. For better contrast, a more susceptible variety should have been used. "Asali Disease" (*Sphacelia Sorghi* McRae) is a less important disease of the ears; there is no control known.

Bulrush Millet diseases are more limited. The only one to be controlled is Downy Mildew. "Asali Disease" (*Sphacelia* sp.) will require control as soon as a method is discovered.

From *Barley* leaf-stripe *Helminthosporium teres* Sacc. has been isolated (N. J. G. Smith).

Rye was observed in various districts heavily infected by the brown rust *Puccinia secalina* Grove.

Rice has been observed near Kilosa with the "False Smut" (*Ustilaginoidea virens* (Cke.) Tak. What appears to be an Actinomycete is common on the glumes. *Helminthosporium oryzæ* B. de H. was also identified on glumes (N. J. G. Smith).

Sugar-cane.—The following records require to be made; *Armillaria* root disease was observed, probably for the first time on this host plant. Rhizomorphs were found externally, and the tissues were penetrated by white mycelium, black lines occurred. *Melanconium Sacchari* Mass. is common on stalks and sheaths. *Leptosphæria Sacchari* v. Breda de Haan was observed on leaves.

Legumes.—On gram (*Ph. mungo*) a *Cercospora* sp. (probably *C. cruenta* Sacc.) is comparatively common. On sword bean (*Canavalia ensiformis*) a leaf spot is common, caused by an undetermined *Cercospora* sp., apparently not *C. canavaliæ* Syd. Rot of the collars and roots caused by *Sclerotium Rolfsii* has been seen on groundnut, Madagascar or Bambarra nut (*Voandzeia subterranea*), lucerne, lupin, and sword bean. Mildew (*Erysiphe Polygoni*) has been seen on groundnut and Madagascar nut in various districts. "Rosette Disease" is common on groundnuts: two varieties, "Basse" and "Philippine White", having the reputation of considerable resistance to this disease, have been obtained from the Department of Agriculture, Nigeria. These are being sown in the coming year for trial and multiplication, and if satisfactory will be distributed to planters.

Sesame.—Preliminary observations have been made on the diseases of sesame in the Territory. The two most destructive are what may be called "Leaf-Curl", which is probably caused by a virus, and a bacterial disease of the stems, branches and leaves. There are two leaf fungi: Mildew (*Oospora* sp.) and what is now referred to provisionally as *Helminthosporium gigasporum* B. & Br. subsp. *javanicum* Penz. & Sacc. The observations to date on each of these diseases have been recorded in Mycological Circular No. 3, 1932 (the *Helminthosporium* is referred to there as *Cercospora*, to which it is closely related).

Potato.—A discoloration of tubers has not been finally determined, but might equally well be "Spraing" or "Net-necrosis", both bacterial diseases. The effect is to reduce the market value or render the crop unsaleable. A number of varieties have been introduced to test their susceptibility to the disease under the conditions existing.

Cassava.—*Armillaria* root disease is now recorded on this crop; it can be exceedingly destructive, rendering the roots quite useless. On the same roots perithecia of a species of *Eutypella* were present. "Leaf-Curl" is already well-known. The possibility of obtaining resistant strains of the important varieties is being investigated. What is probably the same disease occurs commonly on ceara rubber. On dried-up stems, on a sandy soil, *Botryodiplodia manihotis* Syd. occurred. On leaves perithecia which are probably *Mycosphærella manihotis* Ghesq. & Herrard appeared in small numbers, causing angular spots mostly along the midribs.

Banana.—This is still another plant which requires to be added to the list of host plants of *Armillaria.*

Pepper.—(*Capsicum annuum*) has been observed infected at the roots by *Sclerotium Rolfsii.*

Vine.—On the leaves of grape-vine powdery mildew (*Oidium Tuckeri*) is very common.

Citrus sp.—On scale insects the following two fungi were observed: *Tetracium coccicolum* v. Höhn (the conidial stage of *Podonectria coccicola* (E. & E.) Petch); and *Sphærostilbe aurantiicola* (B. & Br.) Petch, with the conidial stage (*Microcera aurantiicola* Petch) scanty.

Garden plants.—The following require to be recorded: the conidial stage of the mildew *Erysiphe cichoracearum* D.C. on sunflower and Verbena; leaf-spots caused by the white-smut *Entyloma Dahliæ* Syd. on Dahlia; Crown Gall (*Bacterium tumefaciens* E. F. S. & Townsend) were seen in two rose gardens; *Armillaria* root disease on *Hibiscus rosa-sinensis.*

The assistance of officers of the department in submitting material for study, and in carrying out field work, is gratefully acknowledged.

G. B. Wallace,
Mycologist.

ANNEXURE VII.

REPORT OF THE SENIOR AGRICULTURAL ASSISTANT.

The duties of the Senior Agricultural Assistant are divided between the Morogoro Experiment Station and Head Office.

2. Very satisfactory progress can be recorded on the regeneration of the fruit orchards on the station. New blocks of March's seedless grapefruit budded to shaddock seedlings, lemon, lime, tangerine and Sampson Tangelo have been established and are thriving. Suitable stock plants have been planted in further blocks *in situ* and will, in the near future, be budded with the following varieties:—Washington Navel, Jaffa, Mediterranean Sweet, Valencia Late and Navelencia.

3. Budwood of the McCarthy, Duncan and Triumph grapefruits, Ruby Blood, Binti Juma and Pineapple oranges, Cape nartje, Villa Franca lemon and Ragpur lime was obtained and all successfully budded on to stocks in the nursery.

4. In addition to the citrus, blocks of tung oil (*Aleurites Fordii*) and budded avocado have been established. The former is growing particularly well.

5. In regard to the nurseries, the old citrus nursery is being abandoned, and a new nursery, to include all fruit trees, has been made as an extension to the existing nursery for ornamental plants. Some thousands of citrus stocks of all kinds are being grown and in addition there are beds of avocado, mango, litchie, breadfruit, anonas, guavas, cashew nuts and sapodilla. Mango seedlings, which were growing in the old nursery beds, have been budded and grafted to superior local kinds and it is hoped to extend this work to embrace all good varieties within the Territory. Experience here with budding and grafting the mango shows that, other things being equal, there is nothing to choose between either method.

6. The recommendations of the Agricultural Adviser to the Secretary of State for the Colonies relative to the nursery stock of former days and to the station generally have been carried out.

7. Two consignments of cardamon seed were received from Ceylon and resultant plants distributed to suitable areas chiefly in the Northern Province.

8. Some four thousand cocoa seeds were received from an estate in the Tanga Province. These gave a very successful germination and trial plantings have been made in the foothills of the Nguru and the Uluguru Mountains.

9. Adjoining the nursery are a dozen or so five-year-old plants of *Coffea excelsa* and it was decided to use these for experimental budding using buds from an old Arabica coffee plant which survives on the station from pre-war days. The budding has been very successful, the buds making particularly fine and healthy growth in comparison to that of the plant from which the buds were taken. In a few of the excelsa plants all branches were budded and this has resulted in a complete change over of the trees. A small number of grafts were also put in and the results obtained indicate that the coffee plant

can be very readily grafted. The results outlined above are particularly interesting when it is remembered that the experiment station is only 1,700 feet above sea-level and has a long dry season and that the coffee is grown practically without shade. It is proposed to continue the experiments and seed of the various species of coffee has been obtained for growing as stocks to be used in further budding experiments under nursery conditions.

10. All species of trees in the arboretum have been named and labelled.

11. A randomized block for citrus stock experiments is being planted.

T. H. Marshall,
Senior Agricultural Assistant.

ANNEXURE VIII.

MOROGORO AGRICULTURAL STATION.

Crop Experimentation, 1932.

Rainfall.—The rainfall was heavy compared with previous years although not so heavy as that of 1931. The monthly figures of precipitation (in mm.) together with relative figures for 1931 and for the period 1925-31 are :—

Month	1932	1931	Av. 1925–31
January	47·9	55·0	99·4
February	192·6	115·4	75·7
March	116·5	191·7	156·8
April	175·6	249·1	164·4
May	94·4	172·2	79·7
June	6·7	19·1	20·8
July	9·7	5·7	7·2
August	3·9	6·6	11·2
September	16·9	23·6	23·8
October	3·5	5·3	27·0
November	10·4	29·1	43·1
December	229·3	96·4	93·9
Total ...	907·4	969·2	803·0

2. *Cotton Experiments: Variety Trial No. 1.*—A randomized block experiment was laid down to determine the relative values of the various U4 strains as compared with the local (Upland American) cotton grown in the district. The lay-out of the plots was as follows :—

IV	U4/4	U4/4/10	H77	H67	Z14	U4/4/2	C15	Local
III	U4/4/2	C15	Z14	H77	U4/4/10	H67	Local	U4/4
II	Z14	C15	U4/4/10	Local	H77	U4/4	U4/4/2	H67
I	U4/4/10	H77	U4/4/2	Z14	H67	C15	U4/4	Local

Individual plots were of one-fortieth acre in size, all records (e.g. flower counts, yields of seed cotton, etc.) being taken per plant.

3. The relative earliness of the varieties may be gauged by Graph No. 1. It will be seen that U4/4 and Z14 are earlier than most while the local strain is definitely the latest. A notable feature of the U4 group is that the bulk of the flowers is produced in a well-defined period : this ensures that the bulk of the crop can be picked in a relatively short time. Local cotton on the other hand produces flowers over a much longer period but at a much reduced rate, consequently, many pickings have to be made and much of the late picked lint is damaged by stainers.

(*Graph not reproduced.*)

4. An interesting feature of the graph is the high flowering rate of C15 : the maximum rate of flowering, however, is attained when the rest of the

U4 group have passed their highest flowering rates. C15 has given the lowest yield of seed cotton (33·0 grams) with the exception of H77 and Local. This is accounted for by the high rate of boll shedding.

5. Fortnightly pickings were made commencing from 4th August. The total yields of seed cotton picked per 100 plants were :—

Variety	Yield in grams
U4/4	42·50
U4/4/10	40·00
H77	30·00
H67	34·25
Z14	36·00
U4/4/2	44·25
C15	33·00
Local	27·25
Mean	35·91
Standard error	2·08

The table of the analysis of variance is set out below :—

Analysis of Variance.

	Degrees of freedom	Sum of squares	Variance	Standard deviation	Log Std. Dev.
Treatments ...	7	994·80	142·11	11·9160	2·4783
Blocks ...	3	80·59	26·86	5·1827	1·6454
Error ...	21	554·65	26·41	5·1098	1·6314
TOTAL ...	31	1,630·04	52·58	—	—

The variance of one plot is 26·41, therefore the standard deviation of the difference of two means of four blocks $= \sqrt{\frac{2 \times 26{\cdot}41}{4}} = 3{\cdot}2496$. Now in Fisher's table of t when P = ·05 and n = 21, t is equal to 2·080, that is :—

$$\frac{\text{Difference}}{\text{Standard error}} = 3{\cdot}2496$$

$$\therefore \text{Difference} = 3{\cdot}2496 \times 2{\cdot}080$$

$$= 6{\cdot}7592.$$

All differences in yield which exceed 6·76 grams can be regarded as significant, therefore :—

U4/4 is significantly superior in yield to H77, H67, C15 and Local.
U4/4/2 is significantly superior in yield to H77, H67, Z14, C15 and Local.
Local is significantly inferior to all varieties except H77 and C15.

6. *Variety Trial No. 2.*—A further variety trial was laid out in the form of a Latin Square to test the Uganda variety, S.G.29, against U4/4, U4/4/10 and Local. The lay-out was :—

Local	U4/4	U4/4/10	S.G. 29
U4/4	S.G. 29	Local	U4/4/10
S.G. 29	U4/4/10	U4/4	Local
U4/4/10	Local	S.G. 29	U4/4

The yields of seed cotton of the various varieties are set out below :—

Variety	Yield of seed cotton per 100 plants in grams
Local	32·50
U4/4	51·50
U4/4/10	46·75
S.G.29	27·50
Mean	39·56
Standard error	1·0134

All differences between varieties which exceed 2·48 grams can be regarded as significant, therefore :—

U4/4 is significantly superior in yield to U4 4/10, Local and S.G.29.
U4/4/10 is significantly superior in yield to Local and S.G.29.
Local is significantly superior in yield to S.G.29.

7. S.G.29 has been the poorest in all round qualities of any standard variety grown on the agricultural station. The plants exhibit too much vigour resulting in a low rate of flower production and yield of seed cotton. Similar results have been obtained on observation plots throughout the Morogoro and Kilosa Districts and indicate the unsuitability of S.G.29 for conditions in the Eastern Province.

8. *Cotton Manurial Experiment.*—A manurial experiment was laid down in the form of a four by four Latin Square to test the value of various applications of Blood Meal as fertilizer. The treatments were :—

I = ½ cwt. Blood Meal per acre.
II = 1 ,, ,, ,, ,,
III = 2 ,, ,, ,, ,,
IV = Control. No manure.

9. The fertilizer was applied on 11th February, the cotton seed being planted two days later. No increase in yield resulted from any of the applications of Blood Meal.

10. *Cotton Selections.*—Single plant selections have been made from most of the U4 derivatives, U4 bulk, Local and S.G.29. These will be sown in progeny rows (or plots) in 1933 for observation and multiplication of the best strains (reselection being carried on within these strains until a uniform type of plant is obtained). It is probable that the best results will be obtained by selecting within the local strain of cotton since the lint of this strain is far superior to that of any of the imported varieties, all the U4 strains by comparison having a very harsh and brittle lint which fetches a lower price than that from the local strain of cotton.

11. *Sesame Experiment.*—A spacing trial of sesame was carried out employing high-grade white sesame seed. The plots were laid out in a modified randomized block system.

Broadcast X	B C D A	Broadcast X	A C D B
C D B A	Broadcast X	B A C D	Broadcast X
Broadcast X	A B D C	Broadcast X	A B C D

Treatments:—

X = Broadcast.
A = Rows 2 feet apart. Plants thinned down to single continuous line.
B = Rows 2 feet apart. Plants thinned to 6″ apart.
C = Rows 2 feet apart. Plants thinned to 9″ apart.
D = Rows 2 feet apart. Plants thinned to 12″ apart.

12. The incidence of disease was so high in the broadcast and closely planted plots as to reduce the yield to almost negligible amounts. The diseases present were identified by the Mycologist to be :—

(a) Mildew (*Oospora* sp.).

(b) *Helminthosporium gigasporum* B. & Br. subsp. *javanicum* Penz.-Sacc., causing large brown angular spots on the leaves.

(c) Possibly what is known in Burma as "Green Flowering Disease," the floral parts being transformed into green leaf-like structures.

(d) Bacterial Disease causing tiny black spots on the leaves.

It is considered by the Mycologist that the fungus diseases are largely incidental to the damp conditions caused by close planting, and a wide spacing is suggested in order to overcome this difficulty.

13. *Canadian Wonder* versus *Local Maharage Beans.*—A comparative test between Canadian Wonder and local Maharage did not reveal any definite superiority of the former over the latter. The plots were laid out in the following manner :—

Canadian Wonder	Maharage Staked | Unstaked	Canadian Wonder
Maharage Staked Unstaked	Canadian Wonder	Maharage Staked | Unstaked
Canadian Wonder	Maharage Unstaked | Staked	Canadian Wonder
Maharage Unstaked Staked	Canadian Wonder	Maharage Unstaked | Staked

Plots of one-thirtieth acre in size, the plots of Maharage being subdivided into two, one portion of each being staked. The total yields from the whole plots of the varieties being :—

Canadian Wonder		Maharago
lbs.		lbs.
11·4		10·2
11·5		13·5
11·1		11·5
15·3		13·2
14·7		11·7
13·0		11·6
Total = 77·0 lbs.		Total = 71·7 lbs.
Mean = 12·83lbs.		Mean = 11·95lbs.

Standard error of the mean difference = 0·672lbs. The actual difference between the two means is 0·88lbs., therefore, the difference is not significant.

The relative means for staked and unstaked plots were :—

Staked		Unstaked
6·27lbs.		5·71lbs.
	Difference =	0·56lbs.
	Standard error of mean difference =	0·04lbs.

Therefore the difference in yield due to staking is definitely significant.

14. *Kirabula Maize.*—A quantity of seed of Kirabula maize received from Kigoma was sown in an observation plot. This maize proved to be inferior to both Potchefstroom Pearl and White Cango the standard varieties grown on the agricultural station and as the seed obtained from the plot was of a very mixed nature no further tests are being carried out.

15. *Sisal* versus *Furcræa Yield Trial.*—A yield trial of sisal *versus Furcræa gigantea* was planted up in 1931, the lay-out of the plots being in the "Half-Drill Strip" method. It is evident that the Furcræa grows much more rapidly than the sisal, and as the plants are spineless it possesses an undoubted advantage over sisal in ease of handling. A first cutting has been made on the Furcræa and the results of the decortication will be available in a short time.

16. *Sisal Manurial Trial.*—In order to stimulate interest in the products of Meat Rations Limited, a sisal manurial experiment was laid out in 1931 using "Meraco" Bone Meal. Two treatments only were employed — 2cwts. Bone Meal *versus* control, the plots being laid out in the Faulkner system.

17. *Cassava, Sweet Potato and Banana Varieties.*—Observations have been continued on the collection of indigenous varieties of Cassava, Sweet Potato and Banana varieties. In addition, a multiplication plot of Giant Red bananas has been planted up.

18. *Seed Multiplication.*—Multiplication plots of the main varieties of the more important crops were laid down. There was a considerable demand for maize seed (both Potchefstroom Pearl and White Cango) and at least twice the quantity available could have been disposed of. Two varieties of sorghum were multiplied (Sukesha and Bonganhilo) while multiplication plots of cotton varieties were used for observation purposes and for single plant selection. The following table gives the total yields together with the yields per acre :—

	Total lbs.	Yield per acre lbs.
Maize, White Cango	4,303·2 ...	1,793
Maize, Potchefstroom Pearl ...	7,678·65 ...	2,258
Sorghum, Bonganhilo	1,619·2 ...	2,491
Sorghum, Sukesha	422·4 ...	844·8
Haricot Beans	118½ ...	296
Canadian Wonder Bean ...	32 ...	320
Green Gram	78·2 ...	98
Chick Pea	197 ...	623

19. *Cattle.*—A herd of twenty cows was obtained from the Veterinary Department, Mpwapwa, in the month of August, a Shorthorn grade bull being obtained from the same source in October. Three calves have been born at the agricultural station, one being retained as a stock bull, the remaining two being sold to the Mhonda Mission, Turiani, and to E. Rover, Esq., Lusangasanga.

J. Robertson,
District Agricultural Officer, Morogoro.

ANNEXURE IX.

EXPERIMENT STATION REPORT, 1932.

The Experiment Station, Lubaga.

General.

The new experiment station at Lubaga was inaugurated towards the latter end of the year 1931 when preliminary operations were commenced by the ploughing up of some three hundred acres of land.

2. The site chosen included that portion of the Lubaga area which had been used in the past for duplicating certain experiments being conducted at Ibadakuli and in addition a large area was cleared of secondary bush. One small village which lay within the farm boundary was moved and adequate compensation paid to the native owners.

3. The soil comprises one of the most fertile and productive types of the district and consists of a black loam horizon underlain by a considerable depth of calcium carbonate concretions. The humus content is good but on the higher portions of the farm the soil strata is thin with outcrops of the underlying limestones. Patches of the so-called chocolate loam soil occur on parts of the area and there is a gradual change from the black to red soil on the south and south-eastern boundaries.

4. The cultivated area consists of approximately 350 acres but a total area of 2,000 acres has been earmarked for future use.

5. The establishment of Lubaga marks a new departure in the annals of agricultural activity in the Shinyanga District as hitherto operations have been conducted on the lighter, and predominating cultivated soils, with a view to carrying out investigational work under conditions analagous to those pertaining to native agriculture, however it became apparent that the underlying causes which had located the native agricultural population on the lighter soils were not consequent upon a search for the most productive areas so much as the serving of their requirements for pastoral purposes; to escape the rapidly encroaching tsetse fly; to avoid persecution from adjacent enemies and possibly on account of lack of water, in fact judging by the amount of extremely fertile black soil (still bearing signs of a former cultivation), now under bush and divorced from all human habitation; a comparison of the soil types now in general cultivation with those of a not so far distant past would lead one to believe that productivity and fertility were a negligible consideration where the migration of population was concerned.

6. The present tendency is for natives to return to the black soils and almost without exception the recent land settlement schemes which involve the clearing of large areas of bush are being conducted on these soils.

7. The recent introduction of a new variety of cotton, U/4/4/2, at a time when financial depression was, and still is, the dominating factor in all new advances, rendered it imperative that the necessary multiplication of the seed should be carried out on an area which would give the greatest return possible for the expenditure incurred and therefore in order to expedite reproduction and to eliminate risks as far as possible, Lubaga was considered the most suitable site for such operations.

8. These then were the deciding factors which led to the choice of Lubaga as the site for the new experiment station and notwithstanding our initial object in utilizing the main portion of the farm for seed propagating purposes the main function of the station is fundamentally the same as that of the former station at Ibadakuli namely to afford facilities for the trying out of new and improved varieties of crops; to improve existing crops and to bring to the notice of native cultivators cultural methods which, without financial expenditure can be successfully applied to native agriculture.

9. Apart from the educational value to the natives of the Shinyanga, Tabora and Mwanza Districts it is gratifying to record that the profits which have accrued from the sale of cotton produced at Lubaga during the past two seasons exceeds the sum of £350 all of which has been handed to the Native Administration treasury Shinyanga. The moral effect of this profit, on the chiefs, has undoubtedly quickened their conceptions of the value of large-scale production and played no small part in bringing them to realize that even in years of low prices a considerable return can be gained by increasing acreages and doubling their efforts.

Pests and Diseases.

10. With the exception of Cambodia all varieties of cotton were badly infested with Jassid (presumed *Empoasca fascialis*).

11. The main crop of U/4/4/2 suffered to the extent of an estimated reduction in yield of at least fifty per cent. but the Jassid resisting property of U/4/4/2 undoubtedly averted a more serious loss as it would appear that a non-resisting variety would have been completely wiped out under stress of such a severe infestation. Cambodia completely resisted the attack whilst Webber was rendered a complete failure.

12. The spiny bollworm (*Earias insulana*) and the cotton stainer (*Dysdercus* spp.) were present in negligible quantities.

13. The ravages of smut (presumed *Sphacelotheca Sorghi*) on sorghums, caused slightly reduced yields. Preventive measures were taken to reduce the incidence of smut by treating the seeds before planting with flowers of sulphur but the results obtained were inconclusive.

14. Witchweed (*Striga hermonthica*) proved an extremely troublesome pest to grain crops on every part of the farm. A staff of upwards of one hundred natives was employed periodically to hand pull the weeds which were afterwards burned. If similar measures are taken during the next two seasons it is anticipated that unless reinfection takes place the pest will be completely eradicated.

15. During the whole of the period under review the station was subjected to periodical visitations by locusts (*Locusta migratorioides*). The whole of the farm staff was utilized for driving flyers away from the plots and although occasional eggs were deposited and hatched on the farm prompt measures taken avoided serious loss to the experiments but their attacks rendered our experiment with maize somewhat difficult to interpret.

Meteorological.

16. The season was abnormal insomuch as the rainfall distribution during the established normal planting months of December and January was poor and precipitations were followed by long intervals of drought which considerably mitigated against good germination. Subsequent rains of February until

May were exceedingly favourable both in precipitation and distribution and although low minimum temperatures were recorded ideal conditions for the growth of food crops were presented.

Maintenance and Development.

17. A considerable amount of time and effort was devoted to essential constructional work. The limited means at my disposal necessitated the exercising of the rigid economy and called for no small amount of active manual labour on the part of the Agricultural Assistant and myself. With the assistance of schoolboy apprentices and unskilled farm labour the following permanent buildings were erected :—

(a) European quarters for one officer.
(b) A ten-roomed native quarter.
(c) Two large stores.
(d) Two implement sheds.
(e) An office and laboratory.

The buildings are constructed of cement blocks and corrugated iron and are considered adequate for our present purpose. The success of our building scheme is due largely to the assistance afforded us by the apprentice schoolboys from the Ibadakuli School.

18. Three large ensilage pits filled with chopped green maize provided an excellent food supply during the dry season for the 120 cattle which are maintained for ploughing purposes on the farm.

Experimental Lay-out.

19. In continuance of the procedure adopted for the first time last year at Ibadakuli, times of planting and spacing experiments were correlated and conducted in complete series and yields calculated on the average production from measured rows. Briefly the system is as follows :—

Time of Planting correlated with Spacing.—Complete series of maize, cotton and groundnut experiments were planted whenever planting conditions were favourable but not at less than ten-day intervals.

20. Three or four rows of each spacing were planted 480 feet long. Records are based on calculations from three rows only, the fourth row, where planted, being a dummy row to overcome end row effect, was discarded.

21. In the cotton experiments, the regularity of the stand permitted the estimation of yields on the full 480 feet but in the other two cases yields were based on records from 100 feet length only, chosen as being representative of the most characteristic behaviour of the rows under trial.

Experiments with Maize. *Var. White Cango.*

Time of Planting correlated with Spacing.

Time of Planting.

Spacing	17-12-31	28-12-31	9-1-32	3-2-32	27-2-32	11-3-32	28-3-32
3′ × 1′	797	1,256	386	797	676	48	39
3′ × 2′	1,329	1,039	217	990	676	96	99
3′ × 3′	1,425	870	362	1,208	604	338	132
4′ × 1′	1,053	1,126	472	1,108	436	327	20
4′ × 2′	962	1,147	363	1,053	526	472	104

Figures represent yields in pounds per acre.

22. The correct interpretation of the results given above is rendered somewhat difficult by a number of factors which must be taken into consideration chief amongst which are :—

(i) a certain amount of damage by locusts ;
(ii) depredations by thieves ; and
(iii) the abnormal planting season.

23. The damage by locusts was caused more by locusts in the solitary phase than by swarms of flyers and consequently the whole series of experiments cannot be said to have suffered in an equal respect.

24. Losses from pilfering have seriously interfered with the resultant yields and experimental plots and steps will have to be taken to fence in the more important experiments next season.

25. The abnormal planting conditions referred to under the heading Meteorological are responsible for the all round decreased yields of the January planted series but the advantages to be gained by early planting are clearly evidenced by the results of the December planting.

26. The early February series had the advantage of ideal growing conditions from germination until harvest with an adequate maturation period before the cessation of the rains.

27. The spacing trials are not so conclusive but in the aggregate, as has previously been noted in this area, the wider spacings give the better results.

EXPERIMENTS WITH GROUNDNUTS.

Time of Planting correlated with Spacing.

Spacing	Time of Planting. 18-12-31	29-12-31	11-1-32	4-2-32	28-2-32	12-3-32	29-3-32
12″ × 6″	781	2,252	1,035	2,325	572	281	33
12″ × 12″	935	2,688	890	1,816	717	399	123
18″ × 3″	1,643	1,885	2,078	2,658	604	365	17
18″ × 6″	1,099	1,885	1,450	2,416	592	404	49
18″ × 12″	1,398	1,933	1,450	1,981	580	640	130
24″ × 3″	1,453	1,925	1,380	2,143	572	458	36
24″ × 6″	1,671	1,489	1,744	495	363	80
30″ × 3″	681	1,914	1,421	1,363	369	398	64
30″ × 6″	783	2,291	1,363	1,595	340	398	122

Figures represent pounds per acre of unshelled nuts.

28. The advantages of early planting and close spacing are once again demonstrated whilst the effect of the commencement of the steady rains in February is reflected in the all-round increased yields of the 4-2-32 series.

29. The foregoing results would indicate the advisability of planting groundnuts as soon as possible after the middle of December and except during periods of heavy rat infestations good results would be obtained by planting groundnuts round about that period irrespective of favourable rainfall precipitations. Slight showers are sufficient to induce germination and ample food reserves are contained in the seed itself to enable growth to continue should the main rains at the commencement prove intermittent.

30. It will be noted that the smallest spacing, 18″ × 3″ or 54 square inches per plant has given the best results throughout the whole series thus coinciding with results previously obtained at Ibadakuli.

31. Comparisons between the various spacings in any one series are disappointing as differences are not sufficiently significant to be conclusive but the seasonal performance of the closer planted areas is at once apparent.

Experiments with Cotton.

Time of Planting correlated with Spacing.

Time of Planting.

Spacing	17-12-31	28-12-31	9-1-32	3-2-32	27-2-32	11-3-32	28-3-32
36″ × 2″ ...	575	407	312	368	71	110	82
36″ × 6″ ...	801	556	381	353	98	128	71
36″ × 12″ ...	714	560	391	369	121	155	82
36″ × 18″ ...	658	625	388	407	142	143	79
36″ × 24″ ...	591	488	335	323	134	154	57
30″ × 6″ ...	711	622	400	392	139	117	70
30″ × 12″ ...	575	523	522	377	156	105	66
30″ × 24″ ...	458	532	457	363	156	96	36

Figures given represent pounds of seed cotton per acre.

32. For the seventh year in succession, without exception in spite of abnormal seasons and occasional heavy insect infestations the best yields of cotton have been obtained by planting during December or the early part of January.

33. As the foregoing tables show, the question of spacing requires attention. Extremely close spacings tried for the first time last year at Ibadakuli gave greatly increased yields but this year's results are not entirely in keeping with those findings.

34. The reasons are at once apparent and are as follows :—

Trials this year were conducted with U 4/4/2 variety as against the ordinary Uganda type last year and it has been stated elsewhere that U/4/4/2, on account of its low but spreading habit of growth requires larger spacing than the taller Uganda type. In addition the freedom from white ant attack at Lubaga obviates the necessity for planting as many seeds per acre as possible as an anti-white ant insurance measure.

35. The cramping effect of the 36″ × 2″ spacing (tantamount to be continuous line planting) is reflected in the reduced yields in every series but on less fertile soils than Lubaga it is reasonable to assert that extremely close planting although productive of smaller yields per plant would give greater aggregate yields per acre.

36. When the performance of the crop is regarded in terms of the superficial area allotted to each individual plant it will be seen that the greatest and smallest spacings have throughout the season been productive of the lowest total yields although the margin of difference is in every case hardly significant.

37. The information gained by these results is somewhat contradictory as spacing (f) with 180 square inches per plant was equally as good as spacing (d) with 643 square inches per plant (the spacing usually recommended for this area). Furthermore there is no correlation between the time of planting and the various spacings as a perusal of the figures will indicate a generally declining yield of each series corresponding with the later time of planting. Plantings after the beginning of February have always proved of no concern and therefore these series require no explanation but it is obvious that differences in yields must be expected from variations in spacings of cotton planted at or near the known optimum planting time and as all other possible inhibiting factors have been explored without success the reason for the lack of significant variation can only be ascribed to the extremely high Jassid infestation to which the experiments were subjected.

38. It is reasonable to expect that the closer spacings would offer greater and quicker facilities for the locomotion of Jassids from plant to plant, and the available food supply per plant being extremely small would offer less facilities for the exercising of the plant's recuperative powers after the attack than those of the larger spacings. Conversely the higher spacings may not have presented such ideal conditions for the spread of the Jassid but by reason of the fewer plants per acre the damage done would probably have a greater effect on the yield than that of the lower spacings whilst the recuperative powers would be greater.

39. The spread of the infestation was noted to be more rapid on the closer spacings but as the first four series eventually suffered defoliation and shedding to an equal extent any beneficial results which might have resulted from variations in spacing were masked by the facilities which each spacing offered for recuperative powers as on this, and this alone, depended the resultant yield. therefore it appears reasonable to assume that the various factors were, to a certain degree counterbalanced rendering final results inconclusive.

Barberton Cotton Selections.

40. The following selections from the Empire Cotton Growing Corporation Research, Barberton, have been tried out for the second year and a number of reselections from individual plants have been made :—

	Yield per Acre lbs.
U/4/64/7	776
U/4/64	776
U/4/26/4	768
H. 77	676
Z. 14	645
C. 15	561
U/4/4/10	472
Z. 9	369
Cambodia	315
Webber	184
H. 67	127

41. The U/4 types whilst not proving superior to the U/4/4/2 which we have adopted for general distribution in the Shinyanga District are, nevertheless, useful as a basis for reselection.

42. Increased lint strength has been noted particularly in U/4/4/10 and H.77 and selections have been made. Cambodia proved almost 100 per cent. resistent to Jassid attacks whilst Webber suffered more than any other variety from this cause.

43. Both varieties appear unsuitable from a commercial point of view on account of the longer maturation period and the poor quality of the lint.

44. During next season efforts to obtain crosses between Cambodia and U/4 strains will be made with a view to incorporating the Jassid-resisting properties with those of a better quality of staple.

Cotton Selections.

45. A number of selections were made some of which were finally discarded leaving the following twelve :—

	Lint length ins	Lint index Grams.	Wt. of 100 seeds	Ginning outturn per cent	Remarks
L. 1	$^{13}/_{16}$	2·93	6·59	32·4	F.S.
L. 2	$^{15}/_{16}$	4·39	7·342	37·4	F.S.
L. 3	1	4·05	7·78	34·2	S.
L. 4	1	4·83	9·55	33·5	V.S.
L. 5	$1^{1}/_{8}$	4·750	8·337	36·3	F.S.
L. 6	$^{13}/_{16}$	3·48	6·35	35·4	F.S.
L. 7	$^{15}/_{16}$	5·37	8·36	39·1	S.
L. 8	$1^{1}/_{8}$	5·55	8·97	38·2	F.S.
L. 9	1	4·49	7·03	38·9	W.
L.10	$^{14}/_{16}$	5·175	8·345	38·8	V.S.
L.11	$1^{1}/_{16}$	3·92	7·73	33·6	V.S.
L.12	$1^{1}/_{16}$	5·235	9·6	35·3	W.

V.S. = Very strong; S. = Strong; F.S. = Fairly strong; W. = Weak.

The degree of strength was tested by hand pulling of the lint from a number of seeds selected at random.

46. It has been consistently noted that the lint from U/4 strains although regular is shorter than desirable and in spite of the fact that every cotton plant over an area of six acres was carefully examined no selections of outstanding lint length were met with. Excellent plant structures of high productivity were frequently observed but in the majority of cases the lint length proved disappointing.

Bulk Variety Trials.

47. The yields of bulk multiplication plots are given below :—

Barberton	U/4	... 521lbs. per acre.
Lubaga	U/4	... 470 ,, ,,
Lubaga	U/4/4	... 590 ,, ,,

The seed of the first-named was obtained from Barberton direct last year. The remaining two have been multiplied for the third season. Bulk selections of each have been made for sowing next season and seed is available for experimentation in other areas of the Territory. The strains are not pure but are useful for selection purposes.

Multiplication of U/4/4/2.

48. An area of 210·5 acres was planted, in December, with U/4/4/2 seed at the rate of 6lbs. of seed per acre with a spacing of 3′ × 18″. The whole area was severely infested by Jassid but in spite of this a final yield of 350lbs. per acre was obtained.

49. After the first flush of flowers defoliation and boll shedding resulted from Jassid attacks and caused an estimated reduction in yield of at least 50 per cent. Towards the end of June flowers were again produced in quantity and the resultant second crop of bolls was remarkable for the high percentage of healthy bolls produced. Examinations of large numbers of bolls, produced at the end of the season, in past season, have shown that as many as 98 per cent. of the bolls examined were diseased; these observations were of course made on the old Uganda type and not U/4/4/2.

50. A yield of 350lbs. per acre under such severe adverse conditions clearly demonstrates the inherent resistence of the U/4/4/2 strain to Jassid attacks and our policy in making the seed available for wholesale distribution throughout the district would appear amply justified.

51. VARIETY TRIALS — LEGUMES.

Variety	Yield per Acre	Days to maturity
Sword Beans	1,655 ...	107
White Hopi Beans	763 ...	120
Mat Beans	735 ...	163
Cow Peas	568 ...	152
Lima Beans	414 ...	107
Black Gram	242 ...	83
Tepary Beans	104 ...	89

The merits of the Sword Bean as a green manuring crop are well known but it is to be regretted that with such excellent facilities for its cultivation in this area a market for the dried beans cannot be found.

52. Canadian Wonder beans and Madagascar butter beans were planted but failed entirely. A plot of Fiwi beans (Dolichos), in view of the lengthy maturation period, was fed to stock and consequently no yields are available.

53. VARIETY TRIALS — SORGHUMS.

Variety	Yield per Acre	Days to maturity
Native Mixed	1,489 ...	159
Bonganhilo	1,218 ...	152
Gassabys	1,040 ...	103
Native (Matabotoba)	957 ...	159
Native (Butembe)	948 ...	155
White Hegari	803 ...	116
Red Amber	484 ...	103
Kilinyali	462 ...	161
Feterita	350 ...	117
White Milo	183 ...	95

54. There is wide variation in yields from the different varieties but it will be noted that with the exception of Gassabys the higher yields have the longest maturation periods.

55. The native varieties grown in this area are good yielders but there is a pressing need at the present time for further research on such factors as unpalatability to birds, keeping qualities and smut resistence rather than the investigation of yields and maturation periods. An effort will be made next season to devote more attention to that side of the work.

56. VARIETY TRIALS — GROUNDNUTS.

Variety	Yield	Days to maturity
Mauritius	746 ...	128
Madagascar	1,042 ...	128

Both varieties suffered extensively from Rosette disease and as the yield and quality of the nuts is not outstanding multiplication of the seed will not be proceeded with.

GROUNDNUTS SPACING TRIAL.

57. With a view to ascertaining the effect of extremely close spacing of groundnuts a spacing of 6″ × 6″ was adopted :—

Variety	Spacing	Yield per acre	Days to maturity
Virginia Bunch ...	6″ × 6″ ...	1,750lbs. ...	126

The usual maturation period of Virginia Bunch groundnuts approximates to ninety days when spaces at 2′ 6″ × 9″.

Groundnuts Trials.

58. *Selections* 10, 11, 12, 13, *received from the Transvaal University College:—*

	Yield per acre lbs.	Days to maturity
10	444 ...	156
11	230 ...	156
12	710 ...	156
13	581 ...	156

The performance of the above selections showed no advance on existing types at present in general cultivation. The maturation period is far too lengthy for the requirements of the district.

General Trials.

59. A large number of small packets of seed of various ornamental trees and shrubs was received from the East African Research Station, Amani, and the Botanist, Tsetse Research Department. All the seeds were sown at Lubaga but unfortunately germination in every case either failed or the seedlings afterwards succumbed to the dry conditions prevailing in January. Lack of a water supply on the farm precluded artificial watering and consequently no results were obtained.

H. Marsland,
District Agricultural Officer.

APPENDIX I.

List of European Staff as on 31st December, 1932.

Director: E. Harrison, Head Office, Morogoro.

Assistant to Director: L. A. W. Vickers-Haviland (seconded from Provincial Administration).

Entomologist: A. H. Ritchie, Moshi.

Assistant Entomologist: W. V. Harris, on leave.

Mycologist: G. B. Wallace, Laboratory, Morogoro.

Senior Agricultural Officers: C. K. Latham, on leave; A. S. Richardson, Mwanza; A. J. Wakefield, Head Office, Morogoro.

Agricultural Lecturer: A. E. Haarer, on leave.

District Agricultural Officers: L. C. Edwards, Arusha; D. G. Burns, Tabora; C. M. H. Sutherland, Dodoma; C. B. Garnett, Dar es Salaam; D. Sturdy, Arusha; H. Musk, Mpanganya; A. S. Stenhouse, Songea; C. Harvey, Moshi; C. J. McGregor, Iringa; A. H. Savile, Bukoba; N. V. Rounce, Mwanza; J. E. Bruce, Tanga; B. J. Hartley, Maswa; R. D. Linton, Lindi; J. Robertson, Experiment Station, Morogoro; F. R. Sanders, on leave; H. Marsland, on leave; T. C. Cairns, Shinyanga; F. W. Thomas, Moshi; N. R. Fuggles, Kilosa; J. R. Curry, Singida; G. W. Lock, Lushoto; R. M. Davies, Tukuyu; R. B. Allnutt, Masasi; D. Thornton, Musoma; J. G. M. King, Morogoro District; J. C. Eyre, Tanga.

Senior Agricultural Assistant: T. H. Marshall, Experiment Station and Head Office, Morogoro.

Agricultural Assistants: E. T. Ward, on leave; R. W. Collett, Dar es Salaam; T. S. Jervis, Bukoba; L. Leslie-Moore, on leave; G. S. Brown, on leave; B. E. Eustace, on leave; A. Taylor, on leave; W. Sibley-Warne, on leave; C. J. McKrige, Mpapura; W. C. Clarke, Mwanza; A. Young, Bugufi; F. H. Smith, Moshi; L. F. Higgens, Moshi.

Chief Clerk: W. E. Pownall, on leave.

Clerks: C. H. Taylor and D. F. T. Brown, Head Office, Morogoro.

APPENDIX II.

(A).—Distribution of Plant Material during the Year 1932.

Cotton seed	1,206	tons.
Groundnuts	120	,,
Maize	47,975	lbs.
Sorghums and Millets	4,000	,,
Beans and Peas	6,325	,,
Rice	60,631	,,
Potatoes (European)	25,505	,,
Sesame	11,369	,,
Coffee	7,357	seedlings.
Tobacco	212,000	,,
Cassava and Sweet Potato	10,214	cuttings.
Cover crops (seed)	55	lbs.
Shade trees (seed)	44	,,
Wheat, Barley and Oats	1,470	,,
Fruit trees	2	bundles budwood.
,, ,,	23	packets seed.
,, ,,	451	plants.
Ornamental plants (seed)	28	lbs.
,, ,,	820	cuttings.
,, ,,	1,749	plants.
Vegetables	4	lbs. seed.
Miscellaneous	60	packets seed.
,,	151	lbs. seed.
,,	14	bundles roots.

(B).—Plant and Seed Introduction during the Year 1932.

ECONOMICS:—

Annona glabra (from United States Department of Agriculture).
Melaleuca leucadendron (,, ,, ,, ,,).
Blighia Sapida (,, ,, ,, ,,).
Cotton: U/4/4/2 (from Cotton Breeding Station, Barberton, South Africa).
U/4/4/10 (,, ,, ,, ,, ,,).
U/4 bulk (,, ,, ,, ,, ,,).
Wheat: B. 256 (Department of Agriculture, Kenya).
D. 2, B. 7, C. (L) (,, ,, ,,).
K. 2, G. 6, A. 13 (L) (,, ,, ,,).
K. 4, H. 1, E. 3 (L) (,, ,, ,,).
Milletia oblata (,, ,, ,,).
Rice var. Lady Wright (Department of Agriculture, British Guiana).
,, ,, Carolina Edith (,, ,, ,, ,,).
,, ,, Mexican Edith (,, ,, ,, ,,).
,, ,, Storm Proof (United States Department of Agriculture).
Tobacco var. Hickory Pryor (South Africa).
,, ,, Amovello (,, ,,).
Groundnut var. Basse (Nigeria).
,, ,, Phillipine White (,,).
,, ,, (5 vars. from India).
Pueraria Thunbergiana (Yokohama, Japan).
Sesame var. White Bombay (Empire Marketing Board).
,, ,, China White (,, ,, ,,).
,, ,, China Yellow (,, ,, ,,).

Carica Papaya var. Madame Russell (United States Dept. of Agriculture).
,, ,, ,, Solo (,, ,, ,,).
Russian Peas (large white) (through Imperial Institute, London).
Clove seed (Director, Amani).
Macadamia ternifolia (Brisbane, Australia).
Pelargonium (3 vars.) (Botanic Gardens, Cape Town).
Onion (Dhulia) (India).
,, (Bermuda) (Teneriffe).
Crested wheat grass (from Saskatchewan, Canada).
Coronilla varia (from United States Department of Agriculture).
Lespedeza stipulacea (,, ,, ,, ,, ,,).
,, *sericea* (,, ,, ,, ,, ,,).
,, *striata* (,, ,, ,, ,, ,,).
Bombay Mango (scions) (from Department of Agriculture, Zanzibar).
Guava berry (from Director, Amani).
Cocoa seed (,, ,, ,,).
Sweet potato (7 vars.) (from Department of Agriculture, Uganda).
Nandi Cow-pea (from Department of Agriculture, Kenya).
Cardamon seed (Mysore and Malabar) (from Ceylon).
Cajanus indicus (eight types) (from Imperial Econ. Botanist, Pusa).

ORNAMENTALS :—
Flower seeds (20 kinds) (England).
Jacaranda ovalifolia (from Forest Department, South Africa).

APPENDIX III.

List of Ginneries Existing in 1932.

Province and District	Locality	Number of Gins		Licensee
		Saw	Roller	
Eastern :				
Dar es Salaam ...	Ruvu	1	26	Vithaldas Haridas & Co., Ltd.
,, ...	*Dar es Salaam ...	—	8	Liverpool-Uganda Co., Ltd.
,, ...	Pugu	1	18	Abdulrasul and Sons
Morogoro... ...	Morogoro ...	1	28	Tanganyika Cotton Co., Ltd.
,, ...	Mikese	—	20	Japan Cotton Trading Co.
,, ...	Ngerengere ...	—	16	Liverpool-Uganda Co., Ltd.
,, ...	*Mlali	—	18	Tanganyika Cotton Co., Ltd.
,, ...	Duthumi ...	1	12	,, ,,
,, ...	*Mkata	—	12	,, ,,
,, ...	*Turiani ...	—	13	,, ,,
Kilosa	Kilosa	—	18	Juma Haji
,, ...	*†Kimamba ...	—	12	Kimamba Planters Ginning Co., Ltd.
,, ...	Rudewa	—	21	Tanganyika Cotton Co., Ltd
,, ...	Msowero ...	—	12	Kladitis and Samaris
Bagamoyo ...	Bagamoyo ...	—	8	Liverpool Uganda Co., Ltd.
,, ...	*‡Kisauke ...	—	2	S. G. Drosopoulos
Rufiji	Kilimani ...	—	12	Kilimani Estates
,, ...	Logeloge ...	—	8	Logeloge ,,
Mahenge	Kiberege... ...	—	14	Vithaldas Haridas & Co., Ltd.
Lindi :				
Lindi	*Lindi	—	13	Mathuradas Kalidas
,, ...	Mtua	—	6	,, ,,
Kilwa	*Kikanda	1	8	Jaffer Somji & Co.
Tanga :				
Tanga	*Tongoni	1	10	G. Galanos
Handeni	*Mamundu ...	1	—	Kwashemshi Estates
,, ...	Mzundu	1	—	,, ,,
,, ...	Kwangero ...	1	—	,, ,,
Northern :				
Moshi	Moshi	—	6	Moshi Trading Co.
,, ...	Himo	1	12	,, ,,
Mbulu	*Idulu	—	5	M. Michaelakis
Western :				
Shinyanga ...	Usogore	4	—	Bhagwanji Sunderji & Co.
,, ...	*Luhombo ...	4	—	B. E. A. Corporation, Ltd.
Lake :				
Mwanza	Mwanza	—	20	Nakasero Trading Co., Ltd.
,, ...	Murutunguru ...	1	10	White Fathers' Mission
,, ...	Ihale	—	11	Liverpool-Uganda Co., Ltd.
,, ...	Bukumbi ...	—	12	Bhagwanji Sunderji & Co.
Kwimba	Nyambiti ...	2	6	British Cotton Growing Association
Maswa	*Nyanguge ...	2	8	,, ,, ,,
,, ...	Pambani ...	—	11	Kampala General Agency
,, ...	*Runere	5	—	B. E. A. Corporation, Ltd.
,, ...	*Malampaka ...	5	—	,, ,,
,, ...	Nasa	—	12	Narandas Rajaram & Co.
Biharamulo ...	*Biharamulo ...	2	—	British Cotton Growing Association

*Not licensed in 1932. †Non-native cotton only. ‡Private ginnery.

APPENDIX IV.

TANGANYIKA TERRITORY — PRINCIPAL EXPORTS, 1913 AND 1928-29-30-31-32.

Export	1913		1928		1929		1930		1931		1932	
	Quantity Cwts.	Value £	Quantity Cwts.	Value £	Quantity Cwts.	Value £	Quantity Cwts.	Value £	Quantity Cwts.	Value £	Quantity Cwts.	Value £
Sisal	416,680	535,580	723,720	1,111,429	914,560	1,485,593	999,240	1,172,315	1,118,780	707,177	1,211,080	698,202
Hides and skins ...	69,120	274,511	65,848	374,830	50,988	223,002	41,872	123,471	42,220	83,915	54,360	99,474
Cotton	43,840	120,753	97,863	495,405	98,948	487,863	73,414	247,413	48,526	119,752	64,180	183,747
Copra	109,540	117,401	186,360	191,197	158,400	145,015	147,900	109,733	144,680	62,209	145,300	64,694
Groundnuts... ...	179,220	95,932	211,900	188,582	155,300	120,448	346,660	186,567	61,400	28,706	317,460	182,010
Beeswax	11,180	70,743	9,815	71,079	6,721	48,149	3,773	20,297	12,143	47,010	7,820	31,965
Coffee (raw)	21,180	46,563	208,622	739,657	177,140	588,871	230,940	397,040	185,020	247,037	227,240	463,597
Sesame	29,520	20,407	64,300	61,342	85,120	74,773	62,300	32,547	76,560	36,715	96,220	50,130
Rice	15,420	8,717	79,973	85,884	51,884	58,985	90,131	73,682	95,095	51,209	107,700	62,939
Millet	18,210	5,498	154,636	52,243	95,323	30,334	36,288	8,234	105,407	20,710	70,580	14,911
Total ...	913,910	1,296,105	1,803,037	3,371,648	1,794,384	3,263,033	2,032,518	2,371,299	1,889,831	1,404,440	2,301,940	1,851,669

APPENDIX V.

The following table shows the provision and estimated expenditure for the period 1st April to 31st December, 1932:—

DETAILS OF EXPENDITURE.

	Provision for the period 1/4/32 to 31/12/32		Estimated expenditure for the period 1/4/32 to 31/12/32
PERSONAL EMOLUMENTS.	£		£
Administrative (including total cost of Headquarters' staff)	3,145	...	3,346
Scientific staff	2,300	...	2,278
Field staff	20,941	...	20,991
Total Personal Emoluments ...	26,386	...	26,615
OTHER CHARGES.			
Travelling (including Railway Fares and Freight, Travelling and Transport Allowances, Transport and Passages) ...	8,385	...	6,187
Upkeep of Experimental Stations and Plantations ...	2,963	...	2,603
Purchase of Seeds and Upkeep of Ploughing Schools ...	338	...	160
Plant Sanitation and Purchase of Scientific Equipment ...	520	...	329
General Expenditure	821	...	663
Contributions:—			
(a) Scholarship Scheme	1,330	...	1,197
(b) Imperial Agricultural Bureaux	200	...	200
(c) Imperial Bureau of Entomology	500	...	500
(d) Imperial Bureau of Mycology	250	...	250
(e) East African Agricultural Research Station ...	4,500	...	4,500
(f) Colonial Agricultural Service — Central Fund ...	540	...	180
Total Other Charges ...	20,347	...	16,769
SPECIAL EXPENDITURE.			
Anti-locust Measures	3,000	...	1,560
Expenditure from Cotton Cess	1,500	...	1,776
Purchase of Native Tobacco Crop	950	...	440
Local Advisory Committee	11	...	11
Total Special Expenditure ...	5,461	...	3,787